DOCUMENT RESUME

ED 028 499 EA 002 027

A Review of Research and Development Centers Supported by the U.S. Office of Education.
Office of Education (DHEW), Washington, D.C. Bureau of Research.
Report No-OE-12040
Pub Date 69
Note-173p.; Reprint.
Available from-Journal of Research & Development in Education, 122 Baldwin Hall, University of Georgia, Atlanta, Georgia 30601 ($2.00).
Journal Cit-Journal of Research and Development in Education; v1 n4 Summer 1968.
EDRS Price MF-$0.75 HC-$8.75
Descriptors-Cognitive Development, Early Childhood Education, Educational Administration, *Evaluation, Higher Education, Instructional Programs, Learning, *Objectives, *Program Effectiveness, *Research and Development Centers, School Organization, Social Structure, Teacher Education, Teaching

Reports from the nine research and development centers funded by the United States Office of Education provide a self-assessment of the centers from the standpoint of their respective goals, the methods used in pursuing these goals, estimates of their success to date, and estimates of their projected success. Discussion of organizational aspects and detailed reports of dissemination activities are omitted. The reporting centers are (1) Center for the Advanced Study of Educational Administration, (2) The Learning Research and Development Center, (3) Wisconsin Research and Development Center for Cognitive Learning, (4) Research and Development Center for Educational Stimulation (3-12), (5) Center for Research and Development in Teaching, (6) Research and Development Center for Teacher Education, (7) Center for Research and Development in Higher Education, (8) Center for Study of Evaluation in Instruction, and (9) Research and Development Center for Social Organization of Schools. (TT)

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a review of RESEARCH AND DEVELOPMENT CENTERS SUPPORTED BY THE U.S. OFFICE OF EDUCATION

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PREFACE

The Research and Development Centers supported by the United States Office of Education jointly with the nine universities at which they are located are a relatively new phenomenon in American education, the oldest center having been established less than five years ago. They represent an attempt to take advantage of the staffs and resources of selected institutions of higher education to mount substantial efforts to improve American education in significant ways through a systematic long-term program of research and development on the chosen focus of each of the respective centers. Selection of these institutions for centers, funded originally for five years but with the premise that excellence of contributions would likely warrant extension of the grants for another five years, presupposed strong original staffs and the prospect of augmenting these staffs with additional productive professional personnel. Each university center was chosen, too, for its special capabilities to do research in the area of its focus, for the strength of its relationships with relevant local, state, regional, and/or national institutions, and for evidence of each university's commitment to active support of its Research and Development Center's program as a major thrust of the university's total program.

The purpose of this issue of the *Journal of Research and Development in Education* is to present for the first time in any single publication an assessment of all nine of these USOE-funded Research and Development Centers: an assessment from the standpoint of their respective goals, the methods used in pursuing these goals, an estimate of their success to date, and an estimate of their projected success. Each center was asked to present its account in these terms. At the same time, the center was urged to omit discussion of its organizational aspects and any detailed report of its dissemination activities. It was felt that the emphasis on goals and progress toward them would give a unity and parallelism to the several treatments and that current and prospective product, rather than operational structure or machinery for dissemination of the product, was the prime basis for evaluating the promise of these Research and Development Centers as forces for improvement in education. . . .

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THE CENTER REPORTS

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CENTER FOR THE ADVANCED STUDY OF EDUCATIONAL ORGANIZATION

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Introduction

The organizational and administrative arrangements that prevail today in the American school may have been well adapted to the instructional techniques in the first half of the Twentieth Century--to the textbook-dominated classroom where one teacher confronted thirty to forty pupils each period or day and engaged them in an instructional pattern of lecture, assignment, recitation, and examination--but it is by no means certain that they will be appropriate to the instructional techniques of the year 2,000.

There is already some indication that the American school will be unable to capitalize on the emerging instructional patterns without some fundamental structural and procedural changes. It is possible, for example, that the notion of a geographically-bounded school district will be outmoded as a unit for organizing instruction, especially considering the modern communications technology that makes distance and space irrelevant parameters. The traditional allocation of authority in the school may be unrealistic in view of changes in the teacher's role demanded by new instructional techniques. And it is likely that instruction cannot continue to be carried on in relatively autonomous self-contained classrooms through which students are moved in narrowly graded age cohorts. Alterations in this traditional instructional pattern will undoubtedly change the entire organizational character of the school.

In whatever ways the school may need to be re-structured, however, difficult problems of organization will remain. Thus, focus of the research and development work of the Center for the Advanced Study of Educational Administration is on the organizational and administrative implications of instructional change, with particular reference to public elementary and secondary education in the United States. Within this focus, the general objective of the Center is to *develop organizational and administrative arrangements for the educational enterprise that can accommodate rapidly changing instructional techniques, strategies, and goals.*

When the Center for the Advanced Study of Educational Administration was established at the University of Oregon in April of 1964, its objective was broadly defined as the improvement of educational administration and school organization through programs of basic research, applied research and development, dissemination, and training.

The problem area chosen for the Center was the social context of educational organization and administration, with the term "social context" defined as the environments, both external and internal, in which educational policies are formed and operating decisions are put into effect. Three levels of environment were included in the initial conceptualization of the social context: the educational institution itself, the larger educational systems of which a particular educational institution is a unit or segment, and the larger social, political, and geographic environments in which educational institutions and educational systems are located and which they serve.

For approximately a decade prior to the establishment of the Center, efforts had been made at the University of Oregon to relate the behavioral sciences to the field of educational administration. As part of the nationwide Cooperative Program in Educational Administration, supported by the W. K. Kellogg Foundation, research on the social context of educational administration, interdisciplinary seminars in educational administration, and other cooperative ventures were undertaken. Despite these efforts, however, and despite the imaginative work that had been done in other universities through the country, serious deficiencies existed in the field of educational administration at the time the Center was established. There was a lack of systematic, coherent, and organized bodies of knowledge based upon sound theoretical and empirical work; methodological techniques were limited and relatively undeveloped; applied research and development activities were rarely based upon the findings of basic research; and dissemination programs were seldom related to on-going research and development.

Much of the work that has been going on in the Center during the early years of its operation, therefore, has been designed to make up for those deficiencies. Staff members have prepared surveys of the existing literature and conferences have been sponsored to summarize the available knowledge regarding specific topics within the Center's domain, and the proceedings of those conferences have been widely disseminated. Individual efforts have been devoted to the development of theoretical formulations and methodological approaches to the study of organizations. Research has been conducted on topics ranging from a nationwide study of lobbying tactics to detailed analyses of the decision-making processes utilized by small groups. Support has been provided for post-doctoral fellows and pre-doctroal research assistants in an attempt to increase the quantity and quality of research and development personnel in educational administration.

In all of this, the Center has pursued its objectives through an interdisciplinary approach. Staff members, post-doctoral fellows, and pre-doctoral research assistants have been drawn from both education and the behavioral sciences. In addition to educational administration, disciplines represented by personnel have included anthropology, economics, political science, psychology, social psychology, and sociology. Consistently, Center staff members who are specialists in educational administration have demonstrated competence in the theories and methodologies of the behavioral sciences, and those members who are behavioral scientists have indicated a commitment to research and development dealing with the social context of school organization and educational administration.

A Reappraisal of the Center's Focus and Objectives

Although much of the early work in the Center was directed toward problems that have been popularly conceived as those of school-community relationships, with the passage of time, activities began to focus more and more upon the "internal" aspects of educational organization and administration. Studies of decision making tended to shift from a community to an organizational context; an intensive, longitudinal study of the school principalship was initiated; projects related to innovation and change were undertaken; value and normative structures were analyzed internally as well as externally; and projects on the economics of higher education were expanded to encompass the more general problem of resource allocation.

By early 1968, it was decided that future research and development work would *focus on the organizational and administrative implications of instructional change in public elementary and secondary schools.*

The general objective of the Center's future work--*to develop organizational and administrative arrangements for the educational enterprise that can accommodate rapidly changing instructional techniques, strategies, and goals*--was developed on the basis of three major premises: (1) that increasingly sophisticated research on instructional processes, the psychology and social psychology of human learning, and curriculum design will produce potentially revolutionary teaching procedures in the next 30 years; (2) that existing organizational forms and administrative practices in the school may not be suited to the emerging instructional techniques; and (3) that the absence of appropriate organizational and administrative arrangements can seriously inhibit the introduction of new instructional procedures and can limit their utility once they are introduced. The following instrumental objectives were set to provide more specific directions for research and development and to help in making decisions regarding the relevance to the Center's mission of proposed programs and projects.

Research Objectives

- to formulate models for the analysis of organization and organizational change in the school
- to examine relationships between the organization of instruction and other aspects of school organization and administration, such as resource allocation, goal-setting processes, information flow, coordination, and control
- to investigate interdependencies between (a) social system properties and social psychological processes in the school and (b) the dynamics of planned or unplanned organizational change
- to identify and explicate influences and conditions external to the school that either constrain or facilitate changes in the organization of instruction

Developmental Objectives

- to design and test alternative models of organizational arrangements including patterns for governing the educational enterprise that will facilitate the implementation of new instructional techniques
- to develop strategies for bringing about changes in social relationships that will facilitate the implementation of proposed organizational arrangements
- to develop information processing systems and strategies for decision making designed to enhance instructional management
- to develop instructional materials and procedures for the pre-service and inservice education of school personnel relevant to proposed organizational arrangements

Dissemination Objectives

- to inform colleagues in related research and development fields about the conceptual, empirical, and operational advances realized through the Center's activities
- to inform practitioners and interested laymen about the Center's research and development activities and their implications for educational policy and practice
- in cooperation with other agencies to field test, demonstrate, and introduce into practice the results of development activities conducted in the Center

Training Objectives

- to encourage (but not be responsible for) the establishment of courses of study preparing persons to contribute to research and development activities in domains similar to those of the Center
- to provide a "laboratory" setting for the preparation of research and development specialists
- to contribute to the improvement of programs for the preparation of educational administrators

Research and Development Program

At the present, most of the work of the Center is organized into four major programs: (1) Innovations and Organizational Structure; (2) Career Processes of Educational Personnel; (3) Educational Administration and the Value and Normative Structures of American Society; and (4) Resource Allocation in Higher Education. While much of this work represents a continuation and extension of earlier research and development activites, that contained in the program on Innovations and Organizational Structure represents the fusion of research and development work implied in the Center's objectives.

The long-range objectives of this program are: (1) to determine effective strategies for introducing innovations in schools and school systems; (2) to identify organizational variables which enhance or inhibit the introduction of innovations; and (3) to describe the conditions and processes which make it possible for an organization to adapt to change while maintaining patterns of stability. Particular emphasis is currently being placed upon the development of structural arrangements that will accommodate new curricula and new instructional procedures such as those that are being developed by the R & D Centers whose focus is upon teaching and learning.

While IPI, team teaching, the ungraded primary, modular scheduling, and the like may not exist as such thirty years hence, these developments make it possible to make some hard-headed estimations of what effective instructional methods will look like in the future on the basis of current advances in research and development. These would include:

1. Emancipation of the student from direct dependence upon a teacher in governing the course of instruction. Machines that present the stimuli for learning, provide instantaneous feedback of learning errors, and branch appropriately to present new sequences of stimuli will supplement or supplant the conventional textbook-recitation patterns of the present.
2. Redefinition of teaching as the diagnosis and treatment of learning difficulties on an individualized, clinical basis. High degrees of specialization will be developed among instructional agents along lines other than the usual age-grade or subject-matter division of responsibility.
3. Development of specialized curricular programs built on concrete, relatively short-run objectives and designed for students in unique learning circumstances. Head Start, high school language labs, short courses in data processing procedures, and reading clinics are illustrative.

Two projects constitute the major activities in the program at the present time. The first of these is essentially a research project with developmental implications. The initial objective of the project is to gain an increased understanding of how schools function as formal organizations. The eventual objective is to find ways to enable schools to function more effectively through improved organization. The approach is primarily that of a field study; questionnaires regarding organizational variables are being administered to various functionaries in a variety of school settings. However, the questionnaires are being supplemented by interview and observational approaches. The immediate target groups are administrators, central office personnel, principals, teachers, and paraprofessionals (teachers' aides). The ultimate target groups are those listed above, plus students, since the project is intended to devise improved ways of organizing the school to enhance the instructional function. The basic unit for analysis is the individual school; however, relationships among schools and between schools and central offices are also being investigated. Included in the project sample are schools employing the Individually Prescribed Instruction (IPI) Program developed at the Pittsburgh Learning Research and Development Center, and schools employing the Unitized Approach (Project Models) developed at the Wisconsin Research and Development Center for Cognitive Learning.

An attempt to state all of the assumptions that underlie a research project of this nature would be an almost endless task. It does, however, seem important to state some of the salient assumptions upon which the project is based. First, it is assumed that schools differ in the extent to which they are innovative, and that the causes of these differences can be determined through research. Second, it is assumed that valid instruments for the measurement of differences among schools can be developed. Third, it is assumed that measured variations among the attributes of schools will reveal systematic patterns of variation among these variables. Finally, it is assumed that innovativeness can be planned for and effected through intentional or deliberate interventions.

The second major project in the Innovations and Organizational Structures program, is a developmental project designed to discover ways to help a school system organize itself for effective innovation. To date, relatively little study has been done to improve the functioning of school systems as organizations. Innovation in education has been narrowly focused on the special training of individual teachers, the production of new curriculum materials, or special arrangements such as team-teaching or individualized instruction. This project begins with the assumption that improved organizational processes are often crucial antecedent conditions to a specific innovative attempt. The project is a field experiment; two school systems with comparable sociological characteristics serve as controls. Although the project should benefit the target system, and members of that system are collaborating with that expectation, the primary purpose is a developmental one of testing the effectiveness of group procedures. The anticipated outcomes of the project are descriptions of group procedures for school systems that enhance the organizational effectiveness of the system and increase the possibility that effective innovations will be carried into the classrooms.

Accomplishments

The accomplishments of the Center during its first four years of operation have been substantial and are related to all four areas of activity in which work has been undertaken: research, development, dissemination, and training.

Research

Approximately thirty-five research projects have been completed utilizing various disciplinary and methodological approaches. Although it is impossible to report on all of these here, it is possible to illustrate the scope of the research by discussing a few of the completed projects.

Perceptions of the role of the elementary school principal and teacher. One series of studies has been conducted in an attempt to define the norms associated with the positions of elementary school principal and elementary school teacher. These studies were designed to test the commonly held assumption that performance of organizations is influenced, at least in part, by the extent of agreement concerning rules of behavior and the extent to which expectations are shared. Thus, principals, teachers, and representatives of other community populations in differing types of communities were asked to respond to a role norm inventory to provide data regarding (a) the way principals and teachers viewed their own positions, (b) the perceptions that principals and teachers had of the views of other populations within their communities concerning the roles of teacher and principal, and (c) the actual views of each of the populations of others.

The studies have shown that full agreement on role norms seldom exists. Among both teachers and principals, the levels of agreement range almost continuously from near zero to almost 100 per cent; average agreement among members of each of several populations for a given set of role norms is approximately 50 per cent. Moreover, when comparisons were made between levels of agreement among schools within a given community and the levels of agreement between communities, no significant differences were found. Thus, these studies have led the investigators to question the popular assumption that social order is related to agreement on role norms. The available data from the communities studied regarding teacher morale, attitudes toward a school system and its programs, public support of schools, and teacher turnover do not reflect any appreciable difficulty arising from this apparent lack of agreement.

Educational and community decision-making processes. Another series of studies has been conducted regarding educational decision making and the participation of teachers in decision making in education and other community activities. Using interviews, document analyses, and questionnaires, the researchers attempted to clarify the processes by which educational decisions are made in the context of a local community including the extent to which teachers actually participate in the formulation of educational policy.

The data from the studies provided strong evidence that aspirations for and experience in decision-making activities are limited for most teachers in three ways. First, teachers do not believe it is appropriate for them to participate widely in decision-making activities either in education or in other areas of community life. Second, they have not participated extensively in these activities. Third, teachers do not aspire toward a powerful role in decision making on most educational issues, or, for that matter, on other issues in the community. The teachers' reports of personal experiences as decision makers are consistent with their low aspirations because their role in decision making is quite limited in matters that extend beyond the borders of the individual classroom.

At a more general level, the studies have shown that in a given community the efforts to coordinate education activities and decisions are much less pronounced than are the efforts to coordinate economic activities and decisions. In fact, it has been concluded from these studies that the effectiveness of community power structures, i.e., the influence of formal groups on educational decision making, is greatly overrated. Specialized interest groups in "weak" areas such as education have only marginal claims on the allocation of public resources. Perhaps their role in community affairs is more symbolic and ritualistic than it is decisive, coordinative, or integrative.

The Politics of education. Still another series of studies has been conducted regarding the politics of education. One completed project was a study of the interactions between legislators and lobbyists in Oregon, North Carolina, Utah, and Massachusetts. The theoretical framework for the study was derived from the symbolic interactionist school of social psychology. The problem was to find out why interest groups are powerful in some states and not in others. The investigators assumed that interest groups are powerful in states in which there is sustained interaction between legislators and lobbyists. However, it was also necessary to isolate the factors which contributed to sustained interaction. It was found that those states in which legislators had positive feelings toward lobbyists were high interaction political systems with effective interest groups. The following factors were discovered to be associated with favorable attitudes and, hence, high interaction: (1) the total output of the state system--states with a high annual expenditure of funds attract a disproportionate amount of lobbying activity; and (2) patterns of socialization--states in which legislative careers begin early with a specific area of public policy in mind are productive of sustained interaction systems.

The exchange between legislators and lobbyists is based on the creation of obligations which can then be "cashed in" when needed. Obligations are most frequently created by providing information which the legislator, lacking adequate staff, cannot gather himself. Communication which arouses fear (pressure) is not an effective technique and is used by inexperienced lobbyists.

Problems of school administrators. The findings of a nationwide study which focused on administrators' perceptions of contemporary, emergent problems of educational administration were reported in a Center monograph, *Issues and Problems in Contemporary Educational Administration.* This monograph was chosen by Pi Lambda Theta as one of the twenty-three outstanding education books of 1967.[1]

Other research projects. Other studies completed in the Center have treated such topics as the career patterns of administrative and teaching personnel, the adoption of educational innovations, motivational and personality correlates of successful administrative performance, and community conflict and the politics of education.

Development

Developmental activities conducted in the Center have consisted primarily of devising ways to improve working relationships in the school organization. Six projects have been completed or are currently underway; most of them have been designed to test the effects of direct interventions in the on-going processes of intact work groups in schools. The processes toward which the interventions have been directed are those of problem definition, communications, and problem-solving techniques.

One such project was designed to help the entire staff of a junior high school become more aware, open, and analytic about communication patterns and interpersonal problems among its members. The project directors based the activities on the assumptions that staff communication sets the stage for effective classroom instruction; that interpersonal relations and feelings, communication clarity, and group problem-solving skills of a faculty affect the academic experience of youngsters; and that improved communication and problem-solving skills increase the likelihood that staff members will initiate organizational and instructional changes, both collaboratively and individually. The goal of this project was to help staff members publicly identify problem areas in staff communication; use a systematic problem-solving procedure to improve communication; relate improvements in faculty communication to student-teacher relationships and classroom instruction; and establish a continuing program of activities for improving communication.

The project was designed *not* to have its primary effect on individuals, but on the actual, intact faculty as a working group. A training design was used in which groupings during training were not permanent; persons rotated from group to group to increase identification with the entire staff. This design also makes possible training designs for organizational groups of considerable size. The design included several follow-up sessions during the school year to reinforce what was learned in the initial workshop. The entire project was thoroughly evaluated through pre-test questionnaires and interviews as well as through analysis by an outside, disinterested team of observers.

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[1] The list of "Outstanding Education Books of 1967" compiled by Pi Lambda Theta appeared in the May, 1968 issue of the *NEA Journal.*

Dissemination

The dissemination objectives of the Center have been pursued primarily through two sets of activites: (1) the sponsorship or co-sponsorship of seminars and conferences, and (2) the sponsorship of a publications program. The conferences have dealt with topics related to various facets of the social context of educational organization and administration and the publications program is designed to communicate the findings and implications of the Center research and development work to educational practitioners, to scholars engaged in educational research, and to the general public.

In the CASEA monograph series, the publications *Change Processes in the Public Schools* and *Knowledge Production and Utilization* are collections of papers presented at two conferences.

To date, publications include seventeen monographs, twenty occasional papers, and a number of reviews and bibliographies. In addition, three books based in part upon work completed in the Center have been published through commercial channels and more than twenty journal articles or chapters in books of readings have been authored by CASEA personnel.

Training

Although the Center offers no courses for academic credit and has no authority to grant degrees, it has from the beginning made an important contribution to the training of future research and development personnel in the field of educational administration. During the first three years of its operation, the Center supported thirteen post-doctoral fellows who were interested in improving their research and development skills. Selected from the field of educational administration and from various disciplines in the behavioral sciences, the post-doctoral fellows affiliated with the Center, generally for a one-year period, and participated actively in designing and conducting research and development projects.

In addition, the Center has employed each year from twenty to thirty-five graduate research assistants. Coming from those disciplines represented by the Center's professional staff, the assistants have been given considerable responsibility for helping to design and conduct projects. Not only have the assistants increased their skills in research design and methodology through their affiliation with the Center, they have also acquired substantive information regarding the organization and administration of schools.

Former research assistants and post-doctoral fellows are now holding professorial positions in various academic departments in a number of major universities. Others are currently employed by Federal agencies such as the Regional Educational Laboratories.

Future Research and Development at CASEA

Although a great deal of planning remains to be done to implement the new statement of focus and objectives, it is possible at this point to anticipate some of the future accomplishments of the Center. First, it is clear that future research will be related to a major developmental objective, that of designing new organizational and administrative arrangements to enhance the instructional programs of the schools. Although this should in no way limit creativity in designing and conducting basic research, it should increase the extent to which individual projects are related to each other and, therefore, should increase the extent to which research results are cumulative.

The new statement of focus and objectives is also likely to increase both the quality and quantity of developmental work in the Center. In addition to the activities that are now underway designed to improve social relationships in the schools, a series of new activities will be instituted. Some of these will consist of efforts to develop new models for organizing schools and to test those models in practice. Others will be designed to develop information processing systems based primarily on the use of electronics hardware to enhance both deicison making and instructional management in schools. Still others will be undertaken to produce improved materials for the in-service and pre-service education of school personnel, particularly administrative personnel, and to design new instructional procedures for preparation programs.

In light of the rapidly changing character of the nation's schools, the Center's mission has become one, not of keeping up with change, but one of anticipating change to help school personnel meet the educational demands of tomorrow.

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THE LEARNING RESEARCH AND DEVELOPMENT CENTER

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Purpose and Goals

The Learning Research and Development Center is an institute composed of a faculty from many different academic departments of the University of Pittsburgh. Its general purpose is the scientific study of the problems of learning and instruction with particular attention to the nature of the educational and psychological environment required to maximize the potential of the individual learner. The scope of its activities ranges from basic theoretical research on the learning process; through the development of procedures, materials, and equipment of instruction; to the development of educational programs in school settings for experimentation, tryout, and evaluation. The role of the Center is to provide the climate, the organization, and the facilities for maximizing fruitful interaction between relevant academic disciplines and the study of learning and educational practice. The broad goals of the Center are the following:

1. *To contribute to the growth of those aspects of behavioral science which are relevant to educational practice.* A major rationale of the work of the Center is that research in the behavioral sciences can provide foundations for new educational practices and that researchers sensitive to this possibility can make contributions both to their underlying science and educational research and development. This span of activity fosters a constant interplay between instructional implementation and basic experimental work, each providing insights and substance for the other.

2. *To develop effective prototype models of instructional procedures and appropriate hardware and software through the involvement of scientists, engineers, and educators.* An operating principle of the Center is the belief that if the results of the study of learning by the

researchers are to have practical implications for education, these implications can best be translated into instructional procedures and materials under the direction of the researcher himself. The Center, therefore, encourages the researcher also to be a developer of prototype instructional materials.

3. *To develop and evaluate experimental instructional systems, including materials, procedural components, and personnel training.* Coordinate with its research emphasis, the Center contributes to educational improvement through the development of evaluated systems of instruction. An operating principle is that effective educational change comes about most rapidly through the development and demonstration of full-blown programs which include the necessary material, teacher training, and environmental design to make them operational in a school setting. As programs are developed, they are continually evaluated through the collection of data which provide evidence of the effectiveness of the program and which in turn are analyzed in such a way as to provide specific implications for the further improvement of the program. It is the Center's policy that its work in the school settings is performed for the purposes of research and development; it does not act as a service agency, as such, for the maintenance of ongoing programs.

Research and Development Programs

The Center's activities are carried out in the context of four program areas: (1) Basic Learning Studies, (2) Computer-Assisted Instruction Studies, (3) Field Research, and (4) Experimental School Development. The four program areas provide a context in which different activities can operate and also can exchange appropriate information and personnel. Under each of these program areas are a number of specific projects in which work is carried out.

Basic Learning Studies. In the Basic Learning Studies Program, psychologists and other behavioral scientists conduct research on learning that may be basic to the development of instructional materials and procedures. Since basing educational practice on the science of learning is an important goal of the Center's total program, independent scientists working with small research staffs are investigating a variety of learning phenomena. These basic research studies are carried out in a laboratory context which permits the investigator to achieve a greater degree of control and precision than is normally found in classroom studies. For some experiments, a computer facility in the Center is employed to carry out investigations on-line under computer control. The types of problems that have been investigated include: the properties of response latencies in rote learning (Judd, 1968); the study of the nature of attention through analysis of eye movements (Schroeder & Holland, 1968a, 1968b); the analysis of comprehension skills (Resnick, 1968); study of transfer effects in verbal learning (Kjeldergaard,1968); and the acquisition of discriminations in young children (Cohen, Glaser & Holland, 1968). New areas of investigation initiated in the course of the past year include the study of short-term and long-term memory and study of psycholinguistic variables in learning.

In addition to laboratory studies, many of the researchers are working on developmental activities which are concerned with the application of basic principles to the production of educational materials and procedures, e.g., beginning reading materials (Kjeldergaard, Frankenstein, & Kjeldergaard, 1967), the behavioral analysis of student-teacher interaction, and preschool skills development programs. This duality of research and development activities involving a single researcher permits a work context that assists in providing sustained relationships between basic research and development.

Computer-Assisted Instruction Studies. The second program area, that of Computer-Assisted Instruction (CAI) Studies, conducts research and development on computer-assisted instructional systems (Ragsdale, 1966). This program is concerned with: (a) the analysis of learning processes as students work in partially automated environments, (b) the design of experimental student stations, (c) the study and development of effective CAI courses, and (d) the evaluation of the potential role of CAI in a range of educational applications. A potential contribution of computer-assisted instruction is to provide the learner with a highly responsive learning environment in which he can manipulate subject matter problems in a more interactive way than has heretofore been possible with the usual materials of education. In working on this problem, the Center is interested in and is experimenting with the use of cathode-ray tube displays, specially designed touch-sensitive displays, devices for rapid access to audio and visual displays and a variety of other interface devices (Glaser & Ramage, 1967; Blackhurst, 1965). Engineering research being carried out in this program involves not only the study of how such devices can be used most effectively in instruction, but also of how they can be developed and be economically feasible. Attention is also given to instructional systems management and data processing concerned with the gathering, storing, and retrieving of relevant data on individuals and curricula, and with the decision algorithms which utilize these data (Klahr, 1967).

Field Research. The research in this program is oriented toward basic problems in educational and psychological measurement, including activities in curriculum evaluation and in the assessment of learner behavior relevant to the planning and redesign of instructional systems (Lindvall, 1966). Attention is also given to assessment of the effects of socio-psychological variables on learning outcomes (Brodie & Suchman, 1967). In the context of the Center's experimental school activities, psychometric methods are brought to bear on learning problems in the form of the design of procedures for the assessment of educational objectives, (Cox and Graham, 1966), for the analysis and diagnosis of individual differences relevant to alternative teaching procedures (Glaser, 1968), for the measurement of classroom environments (Yeager & Lindvall, 1968), and for the analysis of curriculum materials and instructional practices (Cox & Vargas, 1966). The Field Research Program designs the testing and evaluation procedures for ongoing Center activities in schools and carries out additional special studies when necessary (Yeager & Lindvall, 1967). Effective use of computer data processing for the conduct of these activities is a major tool, particularly in the development of computer management systems for adapting instruction to individual differences.

Experimental School Development. The primary focus of this program is to develop, test, revise, and study new educational procedures. A central focus is the development of school situations which are highly responsive and adaptive to the requirements of the individual learner. As prototype models are developed, experimental schools are established in which educational and learning processes can be studied and from which data can be obtained which contribute to instructional theory and to the improvement of curriculum materials and practices. Experience has indicated that there is an optimal size for a particular school undertaking--too small a project does not have enough impact in generating significant and sustained redesign of school conditions; too large a project does not permit intensive study or continual improvement based upon information feedback. The mass required is, however, still sizable, and the projects in this program, in order to be most effective, usually require additional resources beyond that of the Center. In some cases experimental school design can be planned for introduction into a cooperating school over a specified period of time. In other cases, especially when specialized materials and equipment or extensive classroom redesign is involved, schools will be invited to bring their classes into the Center's experimental classrooms. The work in this area is focusing on three major projects: the Individually Prescribed Instruction Project (Lindvall & Bolvin, 1967; Glaser, 1968), the Primary Education Project (Resnick, 1967), and the Responsive Environments Project (Moore & Anderson, 1968).

Overall, the Center's four program area--Basic Learning Studies, Computer-Assisted Instruction Studies, Field Research, and Experimental School Development--work toward an integrated research and development setting where each of the program areas can contribute to the work of the other.

Illustrative Activities

Under the space requirements of this report, some illustrative, ongoing activities in each of the program areas of the Learning Research and Development Center will be briefly described rather than attempting to list and summarize in fewer sentences all ongoing Center work.

Basic Learning Studies

Language Comprehension Skills. Several pilot studies on the analysis of syntactic comprehension skills have been conducted which have led to the use of the Eye-Voice Span Technique (EVS) as a convenient means of studying segmenting behavior (Resnick, 1968). In the EVS procedure the subject reads a text projected on a screen. When he reaches a pre-determined word in the text the screen is blacked out, but the subject continues to "read" on for several more words. This procedure yields several scores for each subject. Most important for the work to date have been the subject's average EVS (i.e., the average number of words beyond the light-out position) and count of the number of trials on which the subject stopped reading at a phrase boundary. The former is a measure of how far ahead, in purely quantitative terms, the subject is typically scanning. The latter is a measure of the kinds of syntactic units he is using as he reads. Measures of speed of oral reading and more refined syntactic scores can also be derived from the basic EVS data.

Studies completed during the past year have confirmed the findings of other investigators that both size of scanning unit and tendency to pause at syntactically appropriate phrases in the text increase with age (third grade to college). However, in the youngest readers there was no significant association between reading in longer units and reading in syntactically appropriate units. This lack of relationship could be due to the overwhelming attention new readers must give to the problem of simply recognizing t words. To explore this possibility, an experimental condition was used in which college students read slides projected upside down in order to create a task analogous in perceptual difficulty to the third grader's. Under these conditions both length of unit and syntactic appropriateness declined drastically (to about the third-grade level) but the association between the two scores was actually heightened. This finding suggests that once a relatively strong degree of syntactic control in reading is established (as it is assumed to be in college students), the introduction of perceptual difficulty will make it less manifest. However, if a subject is able to overcome the perceptual problem, he will automatically bring his syntactic responses back into play. In third graders, where the syntactic behavior is weak altogether, increased perceptual skill will not affect the syntactic character of reading units.

These findings suggest that training in speeded reading, which ought to extend average EVS, should have different effects on college and younger subjects. This hypothesis is being investigated in college students, using students in a university speed reading course as subjects. A parallel study using young children is being planned. Also of interest is the relationship of various EVS measures to the subject's ability to predict missing words in a text (cloze procedure) and ability to answer questions based on the text. Both of these measures are aspects of "comprehension." An additional concern is the relationship of the EVS phenomenon to short-term perceptual memory, and studies are now being conducted to determine the extent to which subjects of different levels of reading still are actually "processing" language as they scan ahead.

Response Latency. A second area of investigation, response latency (Judd, 1968), is of relevance to instructional decision making since latency may provide a measure of learning strength after correct response frequency or response probability measures have reached an asymptote. It is known, for example, that retention is increased by overlearning, but specifically, how much overlearning is required for a particular individual? If individuals differ in the amount of practice for initial learning, it can be assumed that they also differ in the amount of overlearning practice required to achieve a desired degree of retention. The problem arises of how to decide when a subject or individual has received enough overlearning practice or when a student has reached a sufficient overlearning criterion. An error rate, or response probability measure, is of little value during this stage since the student has learned the response and is consistently correct; at this point, response latency may provide a basis for deciding when to discontinue overlearning practice. In order to investigate this problem an experiment was run under on-line computer control, which examined changes in latency over the course of learning a short list of paired-associate items.

The data obtained indicated that over the course of learning prior to the trial of last error, latencies showed little change and did not reflect the change in associative strength indicated by a substantial increase in correct response probability. There were no systematic differences between the latency of correct and incorrect responses during this period. In general, it appeared that latency was not a valid measure of learning during the early stages of this paired-associate task. In contrast, a significant finding was that subsequent to the trial of last error, there was a large and consistent reduction in latency. Since this reduction in latency accompanied overlearning practice, there is the suggestion that the increase in response speed during overlearning will provide a measure of the subject's degree of overlearning and might predict subsequent retention. The possibility that latency did measure overlearning was indicated further by the finding that those items which required a greater number of trials to reach criterion in initial learning tended to have longer latencies after the trial of last error.

Work is in progress to continue the evaluation of latency measures as indicators of overlearning and predictors of retention. An experiment underway involves sustained overlearning in a paired-associate task in order to establish whether or not response latencies reach a stable asymptote and whether or not this asymptote is related to the rate with which the item is initially learned. A subsequent experiment will control the amount of overlearning on the basis of latency measures and will measure retention of the material following a period of drill on interfering material. This will be done in order to attempt to correlate latency measures during overlearning with subsequent retention. This research program has as its goal the control of retention by training to a latency criterion. The initial work will be concerned with simple paired-associate learning. It is anticipated that a parallel research program will be considered to investigate the utility of latency measures in concept learning situations.

Computer-Assisted Instruction Studies

Of importance to the work being carried out by the Computer-Assisted Instruction Studies Program is the design of experimental materials that can be presented to students via computer control. Therefore, one emphasis of the work in this program has been on the design of experimental courses and on the overall process of curriculum development from the design of materials by lesson writers through computer coding and computer implementation (Nemitz, 1968). The instructional strategy and presentation context of a program designed to teach basic number concepts to three- and four-year old children entitled "Introduction to Numbers" has been completed. Materials preparation, computer programming, and debugging of the first section of the program have been completed and initially tested. The student station used in presenting the curriculum content to the student consists of a touch-sensitive display (Glaser & Ramage, 1967), a slide projector and a speaker attached to a rapid-access audio unit. As a result of the initial tryout, the instructional strategy was revised, and the modified program retested with additional subjects. The new strategy, in addition to providing remedial and forward branching, includes extended review, when necessary, of previously learned numeral discriminations and provision for the student to correct himself after receiving feedback information that he has initiated an incorrect response. This latter aspect of the instructional strategy increases the probability that the student will end each teaching frame with a correct response. Strategies for the remaining sections of the "Introduction to Numbers" program have been programmed for the computer and are currently undergoing tryout and evaluation.

A second program, "Timetelling," has undergone a number of revisions in terms of the instructional strategy employed. Currently, materials preparation is being completed. The student station planned for use with the timetelling program employs the touch-senitive display, rapid access to audio messages, and a voice-key into which the student can speak his response. In contrast to the numbers program, timetelling is designed to accumulate student response histories over relatively large portions of the program and to use them in making branching decisions. Of interest is an investigation of the depth and breadth of response history necessary to make instructional decisions.

Of interest in work with the timetelling course is comparison of the first CAI version of timetelling with other methods of teaching, employing simpler apparatus with less provision for branching strategies. A second version employs a free-standing portable laboratory teaching machine which provides auditory and visual stimuli, multiple-choice responses, and aural responding through a voice-operated relay. The instructional sequence with this portable machine is similar to the CAI version, but the branching strategy is more limited, and multiple-choice responses are required. A third version of the timetelling course employs a linear strategy. The student receives sound messages at various points in the program by operating a special audio-frame tape recorder. Visual presentation is made by means of a booklet in which responses to each page are made by marking over the answer with a chemically treated pen which confirms a response by making visable preprinted material (Glaser, Kaelin & Samuels, 1968). Course design is completed for the latter two versions of the timetelling course and materials preparation is underway.

As has been the plan of the work on Computer-Assisted Instruction, the experimental courses designed will continue to serve as vehicles for experimental studies to evaluate instructional strategies, human engineering aspects of student consoles, and computer language design. The depth of response history which needs to be stored to effectively adapt to individual differences is a question of interest. Indices of this history will be investigated, such as error patterns, learning rates, and response latency. The amount and kind of history storage required is a significant area for investigation because it determines required investment in computer hardware and software. In addition, the characteristics of feedback and reinforcement parameters required to actively interest young children in automated stations will be studied.

Field Research

Computer Management. One of the major activities of the Field Research Studies Program has been the design and implementation of a data management system for both classroom management and research purposes. After three years of development, the Center's Individually Prescribed Instruction Project had reached a point of development where information requirements, in terms of student classroom management, demanded that new procedures be developed to provide both the Center project staff and the classroom teacher with rapid access to large amounts of information on student progress. To meet this need, a computer management system was designed that would permit the teacher to operate online with the University Computer Center at any given time in order to retrieve information concerning the students with whom he is working.

There are three locations where the hardware elements of the system are housed: (1) at the school--an optical scanner and card punch, a typewriter console with a card reader; (2) at the Center--a typewriter terminal; and (3) at the University of Pittsburgh Computer

Center--an IBM 360/50 computer. This hardware configuration is connected by telephone lines and provides the capabilities necessary for meeting the needs of both the teacher and the researcher. As student data is generated at the school it is transmitted to the University Computer Center and stored on disc and magnetic tape. The information on disc can be queried by the classroom teacher to obtain background and status data about the student via the typewriter console in a matter of seconds or minutes. The communication terminal located at the Center provides researchers with the capability of carrying out, in a matter of hours, studies requiring larger amounts of data that would have orginally taken weeks to gather and analyze.

Of considerable importance during the initial period of development of the system was the specification of the types of information required and the formating of this information. It was only after this very time-consuming activity was completed that efforts could be directed to developing and testing the required computer programs necessary for making the system operational. To date, a few classroom management programs are now running, and the retrieval and analysis programs for the research and evaluation aspects are operational.

One of the goals of the system is to develop a procedure for using available student data to develop for each student a suggested prescription for consideration by the teacher. It is through this constant feedback of information concerning the instructional operation of the school that teachers and researchers can endeavor to improve student performance.

Rate of Learning. Another area in the Field Research Studies Program that has been of continuing interest is the study of problems associated with measuring student rate of learning and student factors associated with it (Yeager & Lindvall, 1967; Wang, 1968). Although studies on this variable have been undertaken in laboratory settings, little has been done to investigate it in an ongoing classroom situation. Undoubtedly, one important reason for the paucity of studies of rate of school learning is the difficulty of establishing a usable measure of rate and of exercising some control over the number of factors that can affect this variable. Perhaps an equally important reason is the difficulty encountered in implementing an operational instructional system where provision is made for students to progress at individual rates. Since the Center's Individually Prescribed Instruction Project provides a setting where students are permitted to progress at individual rates, a number of studies have been undertaken that examine the characteristics of various rate measures.

The types of rate measures examined include days per unit, units per year, skills per year, achievement per day, work pages per day, and skills per day. As individual rate measures, each of the measures presents some limitations in terms of comprehensivenes. These menasures have been studied in terms of their meaningfulness, utility, and relationship to selective student variables. Each of these measures has been examined in terms of its relationship to student characteristics such as intelligence, mathematics and reading achievement scores, attention scores, and attitudes toward materials and subject areas. None of the rate measures was significantly related to any of these variables nor were composite rate measures significantly related to a single student variable or group of student variables.

These results suggest that rate of learning is not a general characteristic of the learner and support the contention that the rate of learning is specific to a given learning task. Plans are now being formulated to continue the investigation of student rate measures and their relationship to student factors and to aspects of the instructional system. As these relationships become known, the characteristics of the instructional system can be modified to maximize the progress of the individual student.

Experimental School Development Program

Individually Prescribed Instruction. One of the major activities of the Experimental School Development Program is Individually Prescribed Instruction (IPI) (Lindvall & Bolvin, 1967; Glaser, 1968). This project was initiated as a feasibility study to determine if it were possible to develop a system of procedures that would produce an educational environment which would be highly responsive to differences among children. The individualization that is being provided for, during the initial years of development, involves individualized lesson plans, individualization of the materials and instructional techniques provided, and achievement of a required level of subject matter mastery for each student.

In order to develop and implement the IPI system, cooperative relations with the Baldwin-Whitehall School District were established and the Oakleaf Elementary School was designated as a laboratory school for the development and testing of the IPI system. Currently the project involves students spending a portion of each school day engaged in IPI procedures in mathematics, reading, and science. Typically, a student spends fifty minutes in each of these areas per day and the remaining time in subject areas taught through more conventional methods.

In each of the IPI curriculum areas, sequences of behaviorally stated objectives have been spelled out and material selected to enable students to achieve mastery of each of the objectives. These materials were not obtained from any single source, but rather from a large number of sources identified through an intensive survey of existing materials. One criterion that influenced the selection of these materials, aside from the specific behaviors that they were to teach, was the extent that the materials could be utilized by the student in studying independent of the teacher's assistance. Whenever commercially prepared materials proved to be unavailable or inappropriate, the Center's staff and teachers prepared materials. Types of materials that have proven useful have included worksheets, individual readers, programmed textbooks, and taped lessons played on cartridge-loading tape-playback devices. In the science program the utilization of taped instructions has permitted students to conduct a series of simple experiments on an independent basis. In reading, considerable attention has been given to the student engaging in independent reading activities in which he is responsible for selecting his own books from either the library or book shelves in his own room on the basis of his interest. Such readings are then discussed with a teacher and with fellow students. By following this procedure, materials are assembled that allow for a maximum use of individual study but with some utilization of small group instruction, large group instruction, and individual tutoring by the teacher.

At the beginning of the school year, each student is given a series of placement tests for the purpose of assessing his entering behavior and determining the level at which he should begin work in each content area. In this manner, both inter- and intra-individual differences in level of achievement are accounted for in the mathematics, reading, and science curricula. The student is then assigned work in the unit in the curriculum continuum for which he indicated lack of mastery, but for which he has the necessary prerequisite abilities. Prior to starting work in the unit, the student is given a unit pretest constructed to evaluate his mastery of the specific objectives included within a particular unit. The student's performance on this pretest is then examined and, as a result of this diagnosis, a series of learning experiences uniquely suited to the individual's competencies is prescribed.

These learning experiences consist of work pages or other instructional materials. A particular prescription contains enough materials to provide a student with work lasting from a single day to a week, depending on the student's ability, the type of units being studied, and the number of experiences prescribed. The student "fills" his prescription by first obtaining materials from the learning center and then working independently, receiving teacher assistance when needed, or in large and small groups under the direction of a teacher. Upon completion of a given learning experience, a student presents his work to a para-professional to grade and record. As the student progresses through each set of experiences, his achievement is evaluated in terms of his performance on the lesson material completed and a series of curriculum-embedded tests.

When a student completes the work for a given unit, which consists of a series of sequential prescriptions, a unit posttest is assigned. If a student demonstrates mastery of the unit on the posttest, he is assigned a new unit of work; if not, a new prescription is written for those objectives where assistance is indicated. It is through this process of continual re-evaluation that a student progresses from one learning task to another at a rate commensurate with his needs and abilities.

As evident from this description of IPI, the teacher's role is somewhat different from that found in more traditional classrooms. The teacher spends a considerable amount of time in studying the progress of individual students and in developing individual learning experiences fitted to the needs of each student. In this role the teacher is not only a source of information, but also a diagnostician and consultant on individual learning requirements.

The work of the IPI project to date points to the feasibility of this type of procedure as one system for achieving the individualization of instruction. Further work remains to be done: (1) to study how learning proceeds in such an educational environment, and (2) to redesign the system so that it becomes increasingly effective in both (a) adapting instruction to learner requirements and (b) allowing the learner to attain the various goals of elementary education. IPI holds promise for positive change in the classrooms of the nation, and it is the intent of the Center to more fully develop all the necessary components of the IPI model in order to fulfill this promise.

Primary Education Project. The Primary Education Project (PEP) is a new experimental school project of the Center. PEP has as its aim the development of an individualized curriculum and a school organization that will serve children in a continuous program beginning at age three and running through the primary grades. Particular emphasis in this work will be on the needs of urban culturally deprived children. Basic to the project is the assumption that the full potential of an early start in formal education can only be realized when the entire school environment, at least through the primary grades, can be made more responsive to the children's needs. PEP is a joint effort of the University of Pittsburgh, Pittsburgh Public Schools, and the General Learning Corporation. The Center is responsible for the research and development activities leading to the design of curriculum, classroom management procedures, and ultimately for the conduct of the general evaluation of the project's effectiveness. The project is now operating on a pilot basis in a Pittsburgh elementary school chosen for its unusually heterogeneous urban population. Children currently involved in this project are in the preprimary headstart classes and the kindergartens and in one first grade class. During the 1968-69 school year, the project will continue to serve preschool and kindergarten children plus the first grade class. In each subsequent year, one additional grade will be added, at least through the third grade.

PEP's major attention in its first two years will be twofold: (a) curriculum design and implementation for preschool and kindergarten, and (b) studies in shaping motivation and attention in learning. One of PEP's major contributions will be a rigorous methodology for curriculum design that is applicable not only to preschool, but to curriculum projects at a variety of levels and in a number of subject areas (Resnick, 1967). The procedure begins with the analysis of behaviorally stated curriculum objectives in such a way as to identify a hierarchy of prerequisites or component behaviors for the objectives. That is, skills or concepts which a child would need to have before he could successfully be taught the new objective. Each analysis specifies one or several sequences of instructional objectives.

The project staff is now engaged in component analysis work in a number of areas considered important in the preschool and kindergarten curriculum. These include: early quantification skills, classification, plan following, motor skills, and certain language skills. On the basis of these analyses, hierarchically sequenced sets of criterion-referenced tests will be constructed. These tests will be the central vehicle for monitoring students' progress. The curriculum will be defined for a teacher by giving her the sequenced set of tests and instructing her to teach her children to pass all the tests. This strategy places a great deal of the burden on the classroom teacher while obtaining substantial school control over the curriculum through these tests. The PEP staff believes that the combination of control of curriculum objectives through tests with freedom of instructional tactics may be an effective means of capitalizing on teachers' strength and also of preventing them from feeling overwhelmed by a too complex system enforced from without. In addition, it is expected that a system defined by tests of mastery performance rather than by specific lessons, will be much easier to revise and modify as more knowledge about children's learning patterns is accumulated.

The basic thrust of PEP's work is based on the hypothesis that intelligence is, by and large, learned by and responsive to experience. To adequately test this hypothesis, a sustained attempt is required to increase the rate at which children acquire, one after another, the key components of intelligence. For such a test it is important that the hierarchies guiding instruction are valid and reflect the natural order in which skills and concepts are acquired. Component analyses of the kind described above take account of existing research on children's learning and cognitive performance. The component hierarchies and resulting teaching sequences must therefore be empirically validated before they can be regarded as authoritative. Concurrently, with the use of curriculum based on component analyses in the school, the project staff will undertake formal validations of the hierarchies described in the analyses. Two strategies will be used. In one, a program of extensive testing on individual components will be followed by examination of the relationships holding between test items for individual children–a non-linear form of scaleogram analysis. A second strategy involves teaching individual children each component that they lack according to the analyzed hierarchy. Such instruction should lead to the establishment of the terminal behavior with relatively little difficulty and would constitute an experimental validation of the hierarchy.

PEP's concern with shaping motivation and attention is based upon the observation that one of the most striking characteristics of young children is their distractability. Some older children, particularly the disadvantaged, the retarded, and the emotionally disturbed possess this characteristic. These children often do not follow directions, and in general show a low level of impulse control. In short, they seem to have problems in orienting themselves in learning. Disadvantaged children typically enter school with still another difficulty because of the characteristic of the interaction with adults at home. They are not used to working with recognition such as approval and disapproval and with the pleasure of completing a task successfully. This is probably because there has been such little occasion for success, and recognition of such at home. These children, in other words, are not motivated to work for the two major kinds of rewards that the school offers: pleasure in doing a task well and social approval. Given this fact alone, it is not surprising to find so many failing in school work. Techniques for systematically and efficiently dealing with deficits of this kind have been developed and applied in a number of classroom settings, particularly among retarded and slow learners. These techniques involve the use of social and other reinforcers in a manner that is systematically contingent on the child's performance of desired behaviors. In the nursey school, however, while certain social behaviors have been studied and modified, very little attention has been paid to the shaping of such behaviors as concentration and task-oriented attention in preschool children.

PEP is currently experimenting with three different forms of applied reinforcers. In one of its preschool classrooms attention to conceptual tasks earns time at more favored activities, such as water and blocks. In the first grade "Reading Readiness Class" children earn tickets during their work period which can be spent for the "rental" of play equipment during recess. In a third classroom, social reinforcement or attention is being used in an attempt to encourage a three-year old child to initiate more social contact with adults and peers. PEP plans to continue studies of these and other forms of behavior modification in the classroom addressing itself in particular to the shaping of attention, direction following, and self-planning skills. PEP will also study systematically the problems involved in gradually reducing extrinsic reinforces while still maintaining desirable levels of motivation and attention. This question has been given only peripheral attention in the applied behavior modification literature to date, and represents a major need before reinforcement principles can be fruitfully applied in a wide variety of settings.

Conclusion

As one looks back on four years of operation of the Learning Research and Development Center, the work of the Center faculty appears to emphasize what they consider to be themes of investigation which are of special significance to research and development relevant in education. These themes are the following: (1) The importance of contact with scientists, engineers and subject matter scholars and the mutual interplay between basic and developmental activities so that a body of technology can be made available for the design of educational practices. (2) The importance of adapting educational environments to the requirements and requests of the individual learner. (3) The significance of evaluation, not only for the assessment of student progress in the course of his education, but also for the monitoring of educational procedures and materials in order to redesign and improve them, and to put their respective contributions to the educational process into the proper perspective.

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WISCONSIN RESEARCH AND DEVELOPMENT CENTER FOR COGNITIVE LEARNING

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FOURTH YEAR REPORT

WISCONSIN RESEARCH AND DEVELOPMENT CENTER FOR COGNITIVE LEARNING

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The agreement between the University of Wisconsin and the United States Office of Education (USOE) establishing the Wisconsin Research and Development Center for Cognitive Learning was signed on August 6, 1964. The problem area of the Center is the improvement of education through a better understanding of cognitive learning. The importance of this problem area may be inferred from six propositions regarding learning and the improvement of instruction.

The first proposition is that concepts provide much of the basic material for thinking. Concepts once learned then served as symbolic mediators between sensory input and overt behaviors.

A second proposition is that concepts and cognitive skills comprise the major outcomes of learning in various subject fields. The identification of concepts and their arrangement in a hierarchical order and the identification of cognitive skills are principal concerns of scholars and curriculum workers in the subject fields.

A third proposition in that the acquisition of cognitive skills enables man not only to acquire knowledge but also to generate new knowledge. When the child has learned the cognitive skills of reading, he can acquire knowledge in the absence of other persons. When he has mastered mathematical concepts and computational skills, he can find solutions to problems not encountered in the same form by any other person.

A fourth proposition is that efficient learning of concepts and cognitive abilities is related to conditions within the learner and conditions within the situation. The former is related to attention and level of cognitive functioning and the later to content and sequence of instruction, quality of equipment and materials, and methods of instruction.

A fifth proposition is that knowledge generated by scholars about cognitive learning, concepts, cognitive skills, and conditions of learning requires *validation* in school settings.

The final proposition is that tested materials and procedures require *widespread use* in school settings in order for educational research and development to improve educational practice.

These six propositions lead directly to the organization of the Center into five programs--three research and development programs, a dissemination program, and a support program. The three research and development programs are *Conditions and Processes of Learning, Processes and Programs of Instruction* and *Facilitative Environments.*

Research and Development Objectives

Each research and development program is characterized by a sharp focus that assures its identity and by a relatedness of content and methodology that facilitates the free flow of information and personnel among programs. Program objectives are stated in general terms; whereas project objectives are stated as outputs to be attained at specified times. The general program objectives which collectively comprise the objectives of the Center, are now described briefly.

Program 1--Conditions and Processes of Learning

To increase our understanding of conditions and processes of cognitive learning, basic research is needed. To test in school settings the knowledge from basic research, relevant models and systems must be developed. To meet these requirements the research and development activities comprising Program 1 are directed toward achieving the following objectives:

To generate knowledge about concept learning and cognitive skills by conducting laboratory-type experiments or research within the school setting.

To synthesize existing knowledge and develop taxonomies, models, or theories of cognitive learning.

To develop educational materials suggested by the prior activities.

Program 2--Processes and Programs of Instruction

Five variables in school settings which are not usually controlled or manipulated in the learning laboratory include subject-matter content and sequence, instructional materials and media, characteristics of students and of the instructional group, characteristics and behaviors of teachers, and organization for instruction. These and other components of an instructional system, including objectives, measurement tools and evaluation procedures, time, and space, require integration into a total functioning system. Thus, research on instructional variables and the development of instructional systems are central to this program. The specific objectives of Program 2 are:

To establish a rationale and strategy for developing instructional systems in the cognitive domain.

To identify sequences of concepts and cognitive skills within and across disciplines.

To develop assessment procedures for the concepts and skills identified above.

To identify existing instructional materials or develop new materials associated with the concepts and cognitive skills.

To generate new knowledge about the various components of an instructional system through research.

Program 3--Facilitative Environments

Achieving the Center objectives requires facilitative enviornments in selected local school buildings, in total school systems, and among various agencies. Program 3 is designed to achieve the following objectives:

To develop and test organizations that facilitate research and development activities on cognitive learning in schools and also facilitate student learning and in-service and pre-service education of teachers.

To develop and test the effectiveness of the means whereby schools select, introduce, and utilize the results of research and development.

General Strategies to Achieve the Objectives

Basic research is carried on in Program 1. Relevant models and learning systems are developed and tested in school settings. Program 1 activities are differentiated into projects. The typical project involves two professors, one of whom assumes primary responsibility, one full-time research associate or project specialist, and from two to six project or research assistants. Current projects are:

101 - *Concept Learning* (Phase 1)
101 - *Situational Variables and Efficiency of Concept Learning* (Phase 2)
102 - *Computer Simulation and Memory*
103 - *Task and Training Variables in Human Problem Solving*
104 - *Language Concepts and Cognitive Skills Related to the Acquisition of Literacy*
105 - *Rule Learning*
106 - *Project Motivated Learning*
107 - *Peer Group Pressures on Learning*

Program 2 deals with processes and programs of instruction. Basic research is conducted to extend knowledge about instructional variables. Prototypic instructional systems are developed and tested. Current projects are:

201 - *Elementary Mathematics*
202 - *English Language and Composition*
203 - *Elementary Science*
204 - *Elementary Reading*
205 - *The Teaching and Learning of Concepts in Verbal Argument*

The research and development activities of Program 3 are concerned with developing and testing new staff organizations and relationships that facilitate a system of individually guided education for children and related research and development activities on cognitive learning in schools, and with developing and testing the effectiveness of the schools' utilization of the results of research and development. The same schools that facilitate student learning also serve as demonstration centers for entire school systems and for the R & D Center. The three main projects are:

301 - *Project MODELS*
302 - *Models for Effecting Planned Educational Change*
303 - *Longitudinal Study of Educational Effectiveness of Reorganized School Districts*

Specific Strategies for Relating Research, Development, and Educational Improvement

The continuous interaction of the Wisconsin R & D Center staff with school people, and also the continuous examination of educational problems by the R & D Center staff, have markedly influenced the development activities of the Center. At the present time much basic research has been generated in connection with development activities.

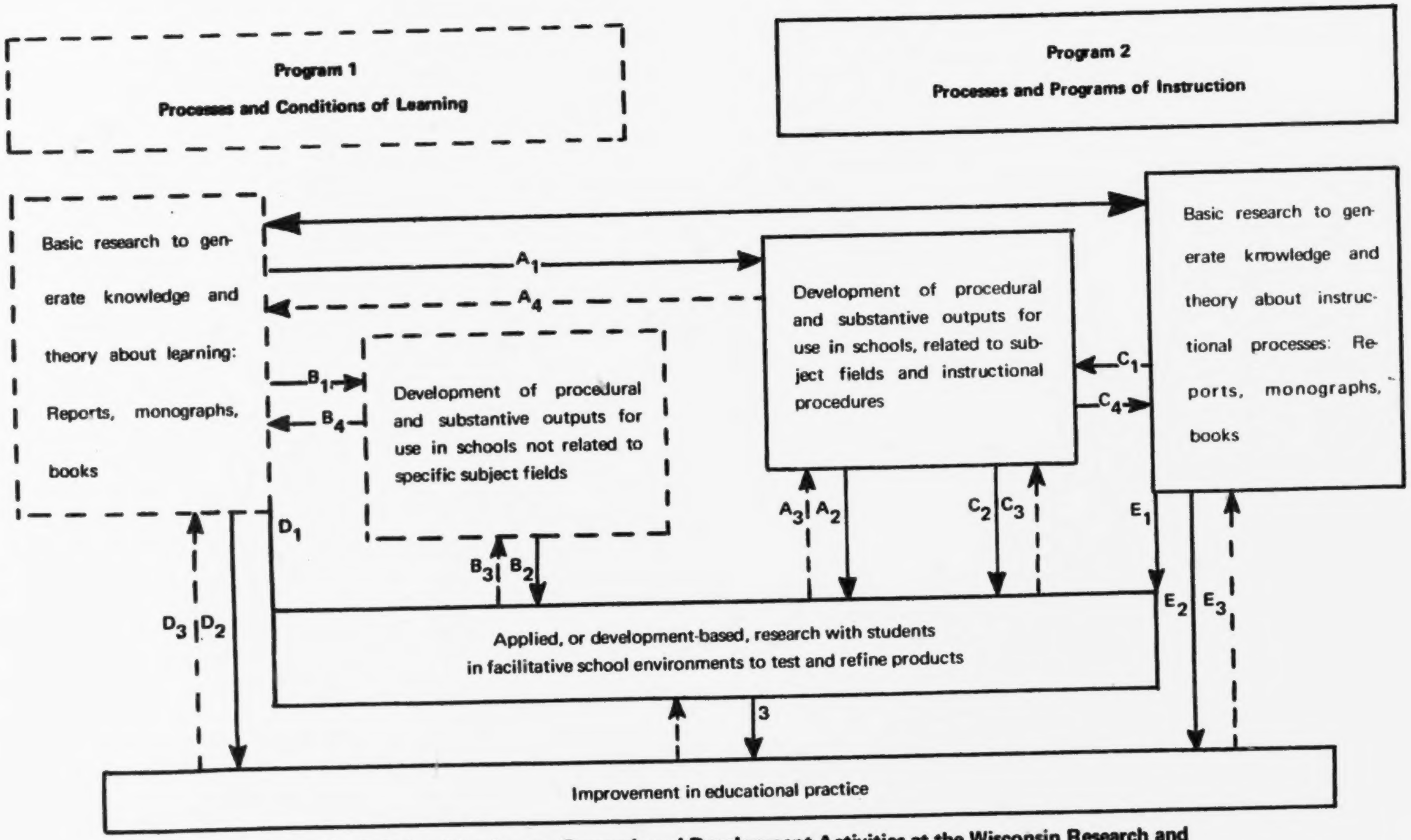
Program 1
Processes and Conditions of Learning
Program 2
Processes and Programs of Instruction
Basic research to generate knowledge and theory about learning: Reports, monographs, books
Development of procedural and substantive outputs for use in schools not related to specific subject fields
Development of procedural and substantive outputs for use in schools, related to subject fields and instructional procedures
Basic research to generate knowledge and theory about instructional processes: Reports, monographs, books
A1
A4
B1
B4
C1
C4
D1
B3
B2
A3
A2
C2
C3
E1
E2
E3
D3
D2
Applied, or development-based, research with students in facilitative school environments to test and refine products
3
Improvement in educational practice

Figure 1. Relationships Among Research and Development Activities at the Wisconsin Research and Development Center for Cognitive Learning

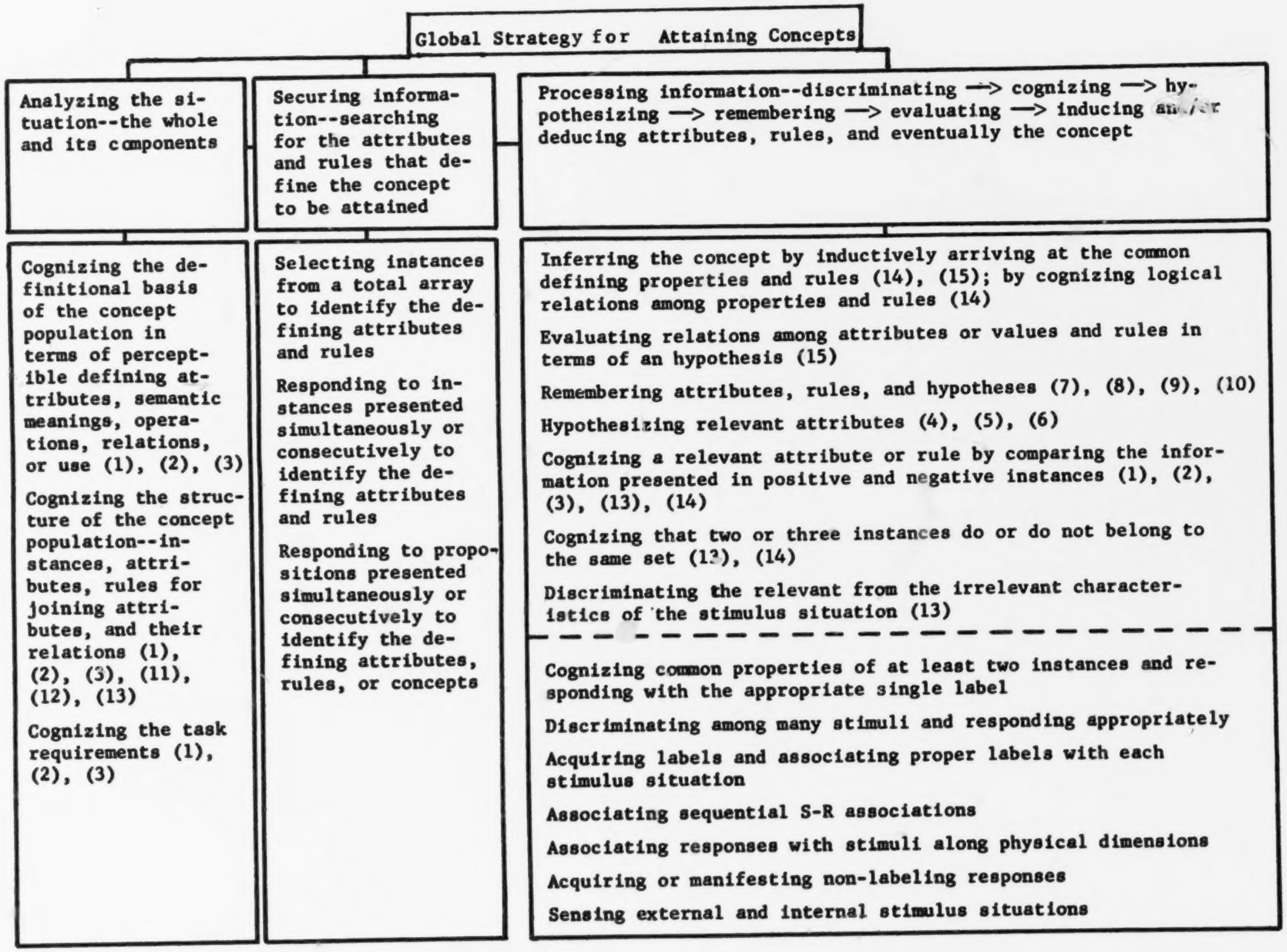
Global Strategy for Attaining Concepts
Analyzing the situation--the whole and its components
Securing information--searching for the attributes and rules that define the concept to be attained
Processing information--discriminating —> cognizing —> hypothesizing —> remembering —> evaluating —> inducing and/or deducing attributes, rules, and eventually the concept
Cognizing the definitional basis of the concept population in terms of perceptible defining attributes, semantic meanings, operations, relations, or use (1), (2), (3)
Cognizing the structure of the concept population--instances, attributes, rules for joining attributes, and their relations (1), (2), (3), (11), (12), (13)
Cognizing the task requirements (1), (2), (3)
Selecting instances from a total array to identify the defining attributes and rules
Responding to instances presented simultaneously or consecutively to identify the defining attributes and rules
Responding to propositions presented simultaneously or consecutively to identify the defining attributes, rules, or concepts
Inferring the concept by inductively arriving at the common defining properties and rules (14), (15); by cognizing logical relations among properties and rules (14)
Evaluating relations among attributes or values and rules in terms of an hypothesis (15)
Remembering attributes, rules, and hypotheses (7), (8), (9), (10)
Hypothesizing relevant attributes (4), (5), (6)
Cognizing a relevant attribute or rule by comparing the information presented in positive and negative instances (1), (2), (3), (13), (14)
Cognizing that two or three instances do or do not belong to the same set (13), (14)
Discriminating the relevant from the irrelevant characteristics of the stimulus situation (13)
Cognizing common properties of at least two instances and responding with the appropriate single label
Discriminating among many stimuli and responding appropriately
Acquiring labels and associating proper labels with each stimulus situation
Associating sequential S-R associations
Associating responses with stimuli along physical dimensions
Acquiring or manifesting non-labeling responses
Sensing external and internal stimulus situations

Figure 2. Hierarchical Arrangement of Cognitive Processes in Concept Learning

The actual sequencing of activities derives from continuous interplay of researching and developing. This interplay is shown in Figure 1. There is not a clear-cut terminal point at which research results are stated and product development begins, nor are there separate groups of personnel, one doing research and another developing. Rather, the research and development strategy involves cooperative effort by specialists in learning, in the subject disciplines, in methodology, and also by teachers or other school personnel.

The B_1--B_2->3 and the C_1--C_2->3 sequences are most typical of present research and development activities at the Wisconsin R & D Center. The A_1--A_2->3 sequence also provides for the development of procedural and substantive outputs, such as instructional materials and equipment for use by students or descriptions of procedures to be used by teachers and other educational workers. In turn, these outputs are researched and refined with school-age children in school settings. Lines D_1 and E_1 indicate that some basic research results may lead directly to applied research in school settings without the intermediate step of developing a product to be used by children or teachers. Also lines D_2 and E_2 show that some research results may be put directly to use in educational improvement.

A community of scholars representing various specialties, some within the Center on a more permanent basis and others from outside the Center on a consulting basis, is an essential component of an effective research and development strategy in education.

Main Outputs Through August, 1968

Outputs of the Center take these tangible forms: Center publications and other materials intended for the educational and research community--scholarly books, technical reports, theoretical papers, practical papers, working papers, and technical memos; Center publications and other materials intended for use by students; demonstration and dissemination of procedural and substantive outputs in selected schools; conferences and workshops designed to disseminate procedural and substantive outputs; working relationships with various development and dissemination agencies; graduate students and other Center staff who acquire greater competence in R & D activities.

Outputs and Results from Program 1, Processes and Conditions of Learning

With basic research on learning, one strategy is to identify a problem area, conduct a series of studies and report them separately and then synthesize and report them in the form of a comprehensive theoretical paper or book. Four projects follow this strategy.

In project 101 on concept learning, 19 experiments were completed to identify the cognitive processes involved in learning concepts. From these a model of strategies and processes was outlined, the basic elements of which are shown in Figure 2, A global strategy was identified and defined as a cognitive control, or plan, for executing three process configurations–analyzing the situation, securing relevant information, and processing the information. Most subjects demonstrate these behaviors in experimental situations but not in a perfect straight-line sequence. There is re-analysis or further information securing when the concept is not attained on the first trial.

Identification of the more specific processes involved in the three larger configurations was the main concern of the 19 experiments.

Information processing is complex and may be viewed in many ways. Beneath the broken line of Figure 2 are noted the elementary operations beginning with sensory experiences at birth and extending hierarchically through the child's properly giving the same label to two instances that differ in some respects and responding to them with the same label. By definition, the child's behavior in properly labeling the two instances as "ball," for example, manifests concept formation. Experiments were not run in this series to clarify these elementary processes. The concern was with the increasingly complex processes, starting with discriminating the characteristics of relatively homogeneous stimuli and ending with inferring the concept inductively, or attaining it by cognizing logical relations among properties and rules. Experiments are now being planned to ascertain the relevance of the model to children of elementary school age forming concepts through reading and related study.

A second project (104) strongly oriented toward basic research is concerned with the identification of concepts and skills that precede beginning reading. A related concern is to isolate the organismic, situational, and content variables that are associated with failure to acquire the essential pre-reading concepts and skills. As knowledge is gained regarding these matters, experimental techniques and related tests for facilitating the acquisition of the skills will be developed.

Substantive results from this project are incorporated in four technical reports and two theoretical papers. The five main conclusions from the research and development activities thus far are as follows: (1) Articulation errors in normal kindergarten children result primarily from the slow motor development. There is rarely a direct relationship between a specific discrimination error and the corresponding articulation error. (2) Discrimination errors are more predictable on the basis of acoustical similarity than on the basis of the functional load of the sounds involved. (Functional load means the frequency with which the sound occurs in English, and the extent to which a sound is critical to discrimination between similar words.) (3) At all educational levels many students fail to utilize the most predictable spelling-to-sound correspondence. (4) Use of spelling-to-sound patterns is highly related to reading achievement and academic performance through the college sophomore level. (5) Even kindergarten children can use parallel syntactic structures to facilitate memory of English sentences.

A third project (107) not leading directly to an output for school use has as its objectives the identification of peer group pressures on the utilization of concepts already learned and also the identification of how group pressures affect the learning of concepts initially. The overall strategy of this project is to investigate such variables as dependence, independence, ordinal position, and social support and then to relate cognition and behavior within the context of response under group pressures.

The results of the research on peer group pressures are incorporated in four technical reports. A synthesis of these and other reports done under other auspices is planned. The main conclusions thus far relate to understanding the psychological bases for the effectiveness of social support (presence of a partner) in reducing conformity to the group. Merely breaking consensus was shown to be not a sufficient theoretical explanation. Moreover, social support was equally effective, whether public or private, whether the group remained the same or not, and whether the social supporter preceded the person or not. Social support was somewhat more effective when occuring first, before the group, than later. When the social supporter was presumably unable, however, to base his response on an independent assessment of reality, then the person was not as independent. Having someone else independently assess the environment seems to be more important in inducing independence than social and emotional factors such as being alone facing the group. In this connection, a surprising result was that in an experiment when the partner was incorrect in his responses 50 per cent of the time, the second person showed independence from the group when the partner was in fact incorrect. The partner was clearly perceived very negatively by the second person. So, a person will be independent from the group when he has an "unlikeable" and "unintelligent" person who agrees with him in opposing the group.

. A fourth project (102) with a strong research orientation is computer simulation of concept learning. The objective is to develop a computer model for the concept attainment process in the Bruner-type concept attainment model. The basic approach to the problem was to translate subject protocols into IPL-V computer programs. On the basis of such protocols, a series of computer programs were developed which stimulate the concept attainment process. The most recent of these models embodies both an operational aspect and higher level cognitive process. The latter attempts to perform the functions of goal directedness and behavior modification as a function of the current state of the learning process. The former embodies those aspects of the concept attainment process concerned with doing, such as comparing, selecting, and transmission of knowledge. The current computer model is capable of performing the various concept attainment strategies derived by Bruner and can also attain concepts using various mixtures of concept attainment strategies. The next level of development of this simulation program will involve a linguistic approach to handling the higher level cognitive processes within the computer program.

Three projects illustrate a second strategy of Program 1 involving less experimentation and more direct approach to instructional improvement. In Project 103 on creative problem solving, experiments were first run on problem solving and then on those elements generally designated by the term, creativity. After a synthesis of laboratory research and an extensive literature survey, a model was developed and reported for teaching creative problem solving. Programed material was then prepared; and now, in the third year of the project, it is being tested with junior high school students. Further experimentation in the laboratory and analysis of the field testing data are being done to ascertain the effectiveness of the program and also the relevance of the model.

The results of these research and development activities are given in one book for junior high school students, *Thinking Creatively*, one technical report, and two theoretical papers. A three-part model for conceptualizing "creativity" suggests how creative thinking may be taught. Creativity profitably can be conceptualized as consisting mainly of (1) appropriate creative *attitudes*, the most critical of which is a favorable attitude toward highly imaginative problem solutions, (2) various cognitive *abilities* which facilitate whatever mental abstracting, combining, perceiving, associating, filling in gaps, etc., contribute to the fluent production of original ideas, and (3) *techniques* for the conscious and systematic production of new combinations of ideas. *Thinking Creatively: A Guide to Training Imagination* incorporates many concepts and principles from this three-part model. It attempts to increase students' awareness and appreciation of novel ideas, to teach techniques for producing new idea combinations, to provide exercise for some creative abilities, and, through humor, to create a free atmosphere encouraging spontaneity and imagination.

A second project (106) taking a direct approach to instructional improvement is concerned with extending the basic principles of classical and operant conditioning to the study of significant functional human behaviors, such as those involved in reading, and also with cognitive learning in young children where the beginning stages of the learning may be investigated. The results of this project are incorporated in three technical reports, one theoretical paper, and one working paper. The theory is incorporated in several books, the first of which appeared in 1964 and the last in 1968. Junior high school students, severely retarded in reading, were taught and also studied during two years. For this purpose initial levels of the SRA reading materials were adopted, with permission, into 230 lessons. These lessons were administered by lay personnel as were also the relevant S-R conditioning principles. Although the results are not completely analyzed, two conclusions are warranted. Severely retarded readers improved in reading skills and related desirable school behaviors, and the principles of conditioning developed in the laboratory are applicable to this complex form of human behavior. In another study culturally disadvantaged pre-school children were taught to acquire reading, writing, and arithmetic behaviors for one year. In general, good progress was made in these skills, as predicted from S-R conditioning principles. A considerable gain from 101 to 113 in Stanford-Binet IQ occurred during a seven-month period. The practice effects, if any, of four administrations of the test during seven months, cannot be determined. Also, the children made a mean gain in percentile score on the *Metropolitan Readiness Test* from 2 to 24 during the same period. The theory, experimental methodology, and training procedures employed in these studies have been continued at the University of Hawaii by the principal investigator since September, 1966.

The third project (105) along the same lines was undertaken as part of the project studying conditions of cognitive learning in school settings. Here a set of generalizations was outlined concerning motivation and related instructional procedures. The instructional procedures were incorporated as treatment variables in six experiments conducted in the elementary school in connection with the acquisition of mathematical concepts or of reading skills. The experimental results and related procedures are being tested to determine how well specified procedures work with children of varying characteristics in several elementary school environments. A motivational system designed specifically for school settings is being formulated. At present the use of individual conferences, concrete and social rewards, and older children as models for younger children have produced exceptional gains in achievement, higher interest in schooling, and more favorable attitudes toward the subject matter.

Outputs and Results from Program 2, Processes and Programs of Instruction

The primary outputs from Program 2 are prototypic instructional systems related to various subject fields. The system is prototypic in that it is an original model, illustrating typical properties of the final system. This assumes that the R & D Center will not produce the final system, including instructional material, that is used by children and teachers. It is a system in the sense that all the relevant components are taken into account, not merely the instructional materials or media. One exception to this is *Patterns in Arithmetic* which is being developed and put into final form by the R & D Center for use by children and teachers. As subsequently noted, other phases of the mathematics project involve the development of prototypic systems, rather than instructional materials in final form.

Developed in Phase 1 of the Center's mathematics Project 201, *Patterns in Arithmetic* is a complete set of materials for Grades 1-6, consisting of a consumable student workbook and a consumable teacher's manual for each grade, 34 videotapes of 15 minutes length for Grade 1 and 64 for each of Grades 2-6. The programs for Grades 1-5 have been developed and tested; Grade 6 will be completed during 1968-1969. Since the television portion of the program is only one or two 15-minute lessons per week for 32 weeks, the classroom teacher is a very important part of the teaching team. The television portion introduces and explains the key concepts being taught, and the supportive material is then used to reinforce learning and to apply the concept in many situations.

Field testing of Grades 1 and 3 programs was conducted in Alabama and Wisconsin with over 9,000 students. In the first grade, almost 70 per cent of the children scored above the median of the national standardization sample. Based on a standardized test, the average third-grade score at the beginning of the year was about one year behind the national mean in computing skills. At the end of the year, the average third-grade score was equal to the national mean score. These students' gains in mathematical concepts were about double that of the sample on whom the test was standardized.

Some teachers also learn both mathematical content and methods from studying the material simultaneously with the children. They do not have to attend evening classes, summer school, or after-school meetings for in-service education before using the program. The television teachers are knowledgeable mathematicians as well as expert teachers.

While still being field tested in 1967-1968, *Patterns in Arithmetic* was used state-wide in South Carolina and Alabama. It was also used in schools served by television stations in Minneapolis, Minnesota; and Green Bay, Milwaukee, and Madison, Wisconsin. Over 100,000 student workbooks were distributed in 1967-1968. *Patterns in Arithmetic* is distributed nationally by the National Center for School and College Television, Bloomington, Indiana.

Proceeding from the outline of content used in *Patterns in Arithmetic,* a second phase of the mathematics project is the development of a prototypic instructional system, kindergarten-Grade 6, that will move in the direction of individually guided education in elementary mathematics, rather than instructional television. At the present time, the instructional units for the equivalent of kindergarten and Grade 1 have been developed for arithmetic. Related research is underway to ascertain how well children of varying characteristics acquire various concepts, pre-concepts, and related cognitive skills. Nearly all children of first-grade age can correctly assign the numbers through 99 to objects and sets. Also, most can identify the correct numerals, but some left-right reversal errors in writing are made. Well-specified instructional procedures are essential for these achievements.

The third phase of the mathematics project involves the development of computer management of individualized mathematics instruction. Already existing materials have been identified, and teaching procedures have been developed for use in the individualized program in the intermediate grades. It is anticipated that the general strategy and procedures developed for computer management of mathematics will subsequently be applied to computer management of reading and of other relevant subject-matters of the elementary school.

The research results of the mathematics project are incorporated in six technical reports and one working paper.

The Center's prototypic instructional system in elementary reading, Project 204, kindergarten-Grade 6, is in the second year of development. Objectives are related to six major categories: word recognition, comprehension, study skills, self-directed reading, interpretive reading, and creative reading. The objectives within each category are tentatively sequenced. During the first year, 1966-1967, 150 exercises were developed to assess children's skill attainment in behavioral terms. Paper-and-pencil group tests are now being constructed to supplement the individual assessment exercises. The group tests will permit more rapid assessment and subsequent placement of each child in the system.

The prototypic reading system was tried out during the 1967-1968 school year in five elementary schools of about 500 enrollment each. Revisions are being made in view of feedback from schools. The R & D staff has identified existing instructional materials related to each objective. Each school has also participated in identifying materials. When the sequence of objectives, the assessment instruments, and the placement procedures are sufficiently refined, computer management of the assessment and placement is planned.

The results of the developmental research on the prototypic reading system and exploratory research on reading are incorporated in eight technical reports, three theoretical papers, and three working papers. Three main conclusions from the research are as follows: (1) Results of standarized tests indicate that the prototypic system in its first year in multiunit schools functions as well or better than other programs. (2) Instructional procedures for developing children's ability to formulate and state literal main ideas derived from reading need to be developed. (3) The roles of various types of cues should be considered in early reading instruction.

In Project 203, a prototypic instructional system in elementary science, the relationship has been studied between several organismic and situational variables and a learner's ability to form classificational, correlational, and theoretical concepts within several of the conceptual schemes developed by the National Science Teachers Association: force, biological cell, chemical and physical change, ionization, and ecological systems. Also, the concepts (scientific, social, and political) related to environmental management are presently being identified.

The results of the research and development activities in science are incorporated in six technical reports and four practical papers. Some of the principal results obtained are as follows: (1) Theoretical concepts are learned by children at the earliest in Grade 3, but only when comprehensible mechanical models are used to illustrate the theoretical concepts; (2) Some classificational and correlational concepts can be learned earlier, but only with instruction which enables the child to have sensory experiences with the labels, properties, and/or instances of the concept (3) The ability of children to form scientific concepts is more highly related to maturity as represented by grade level in school than to IQ within a grade level.

Study of the scheme "the particle nature of matter" has been extended to include a taxonomy of concepts related to the scheme and also the development of a related instructional system for use in Grades 2-6. At this time, a prototypic system comprised of a list of concepts, instructional procedures, instructional materials, and tests, for the purpose of teaching concepts about the particle nature of matter, has been developed initially and is being tried out in Grades 2-6.

In Project 202, a prototypic instructional system is being developed in English language and composition for the junior high school. Twenty-two lessons of programed instruction in transformational grammar have been developed as part of the total program. The materials have proved moderately successful in teaching junior high school students to construct sentences characteristic of mature writers. Each lesson, accompanied by a worksheet to allow the students to apply the concepts and processes learned, can be completed in about 20 minutes with a 7 to 8 per cent error rate. Field test results reveal that eighth-grade students of high, medium, and low IQ learn the concepts well. The program is especially effective with high IQ students. Studies are underway to ascertain why certain concepts are acquired more readily by students of specified characteristics in order to identify the more precise conceptual and maturational factors associated with efficient learning. A complete prototypic system for junior high school grammar, composition, and literature is in the planning stage, the main content for grammar having been identified and the related behavioral objectives having been developed.

The results of research thus far related to the transformational grammar are incorporated in five technical reports. A few of the more important conclusions are as follows: analysis of students' performance on the programed material showed an average time of 21 minutes required to complete each lesson and an over-all error rate of 7.3 per cent per lesson. Sex and IQ showed highly consistent effects: on every test, the high IQ group scored highest, the low group scored lowest, and the medium group scored between the high and the low groups. The results from the experiments also indicated that females tended to score higher on the tests than males. Feedback was a significant factor, the feedback group scoring consistently higher than the no-feedback group. Students who received writing exercises scored significantly higher (p .01) than students who did not receive writing exercises.

In 205, a project concerning the teaching and learning of concepts in verbal argument, *Thinking Critically: A Semi-Programed Introduction to Verbal Argument* has been written in prototypic form to foster the development of critical thinking abilities in high school students.

A taxonomy of critical abilities in the evaluation of verbal argument, based on the Toulmin model, and a hierarchical outline of concepts were developed initially and provided the content for the 18-chapter text. The text is written with three modes of presentation. Traditional textbook form is used in presenting new concepts; linear programing provides immediate practice with the concepts; branching programing offers review when necessary. Accompanying the text are seven tests of abilities critical to assessing testimony and reasoning in verbal argument. The tests may also be used for instruction with the programed text. Teachers whose classes participated in the refinement and validation of the tests have subsequently used the tests as instructional devices.

The semi-programed material has been pretested with a limited sample of high school sophomores. A larger testing program is planned. The tests have been given to several thousand students in order to gather reliability data and to ascertain student norms. Results of the taxonomic investigation of this project are incorporated in an occasional paper. Other papers in progress include the results of work on the semi-programed materials, language variables in argument, and a normative study on student critical-thinking abilities.

Outputs and Results from Program 3--Facilitative Environments

Project 301 of Program 3 is involved with developing and testing an environment to facilitate children's learning, research and development activities of the R & D Center and other agencies, and pre-service and in-service teacher education. This environment, with its related organization, personnel, and procedures, has been established in seven elementary schools of Wisconsin, in a few elementary schools in other states, and in some parts of three junior high schools. Central to the environment is a new organization for elementary schools.

The organizational hierarchy of the multiunit school consists of groups at three distinct levels of operation. At the classroom level is the unit, consisting of personnel in four roles: the unit leader, or professional teacher who teaches from half- to two-thirds time; the regular or staff teacher whose primary functions are to plan, conduct, and evaluate instruction; the teacher aide who assumes many non-instructional tasks formerly required of teachers, such as grading papers and workbooks, assisting children to locate materials and so on; and the instructional secretary who assumes other non-instructional functions formerly assigned to the teacher, namely the typing and reproduction of materials and the keeping of student records. Student teachers, or interns, also participate in some units. Each unit is charged with planning and conducting the total school experience for a group of children, ranging from about 75 to 175 students.

At a second level of organization, the principal and the unit leaders constitute a permanent instructional improvement committee for the building. The principal chairs the group, which meets weekly. This committee may involve consultants from the central office, the State Department of Public Instruction, or other agencies. Decisions made by the committee are communicated and executed by the unit leaders.

At the third organizational level is the system-wide policy committee. Chaired by the superintendent or his designee, this committee includes other elementary principals of the district, representative unit leaders and teachers, consultants, and other relevant central office staff. It meets less frequently than either of the other groups, but its operation is one key to the success of the multiunit school.

The organizational pattern of the multiunit school thus differs from that of the traditional, self-contained classroom school in three ways. First, personnel in the unit work horizontally in teams or committees, thus utilizing teacher strengths and capitalizing upon specialization and interests of all the staff. Second, the replacement of separate classes with large units permits non-grading and related continuous pupil progress. Third, roles are differentiated. One new role is added, that of the unit leader. Also, there is considerable redefinition of the usual roles of principal, teacher, consultant, teacher aide, and instructional secretary.

Results of three years of research and development associated with the multiunit school are incorporated in six technical reports, one occasional paper, and four working papers. Seven elementary schools operated in the multiunit pattern in 1967-1968 in Wisconsin. The organization and related procedures and environment have proven effective in producing large gains in pupil achievement, in facilitating the research and development activities of the R & D Center including its prototypic systems of instruction in reading, mathematics, science, and motivation, and in pre-service and in-service teacher education. Individually guided education is being executed well in the multiunit schools. Here, the school's objectives are outlined for each child by the unit personnel. An appraisal system is implemented. In turn, each child is properly placed in one-to-one and independent study activities, small-group activities, class-size activities, and large unit activities. The whole range of the school objectives as translated for each child is achieved through the various activities. Printed materials and videotapes are being developed by the R & D Center which will be used in 1968-1969 by personnel of the Department of Public Instruction of Wisconsin and four teacher-education institutions in establishing multiunit schools throughout the state and in implementing a state-wide model of dissemination of R & D Center outputs.

The second project of Program 3 (302) is developing models for planned educational change. The first objective of this project is to develop and test system-wide mechanisms which local school systems can employ in utilizing knowledge and innovations of the type generated by the Center. The other objective is to organize knowledge about personnel and organizational roles and functions in educational agencies for improving learning in schools. Four outputs are anticipated from the activities of this project. One is information and knowledge regarding the function and effects of a system-wide change-agent team. The second is knowledge about the nature of appropriate training of school personnel in regard to human relations and problem-solving competencies. Third is a revised model for conceptualizing and managing the change process, and the fourth is a set of revised instruments for measuring selected variables related to change in a school system.

Three school systems initiated change-agent teams late in 1966-1967. Various inputs, especially human relations and problem-solving training, analysis of data collected from both experimental and control systems, and interpretations of the recordings of change-agent team meetings. have been provided to each team. Data are being collected regarding the personnel of the change-agent teams, other school personnel, and students.

Theoretical statements regarding planned educational change, change-agent teams, and human relations training are incorporated in an occasional paper. The main preliminary conclusions after the first year of operation of change-agent teams follow: (1) There is little systematic development in the change process for school systems during this preliminary stage; (2) The Guba-Clark schema (revised) used as a backdrop to examine the change process is not sufficient to provide the descriptive data upon which to base firm conclusions about educational change as it occurs within a school system; (3) The change-agent teams under study are not yet fully committed to a role wherein they function at a high effectiveness in systematically diagnosing problems, planning action, transforming strategy into action, and evaluating action results.

Outputs Associated with Training

One hundred five graduate students were employed on R & D projects during the first three years. The students pursued majors in these University departments: adult education, agricultural and extension education, Chinese language and linguistics, communications and public address, curriculum and instruction, conservation education, educational policy studies, educational psychology, elementary education, English, guidance and counseling, human development, linguistics, mass communications, mathematics, mechanical engineering, political science, psychology, radio and broadcasting, recreational education, science education, and speech. Twenty-eight students were awarded the PHD during the first three years. The 23 PHD recipients during the 1966-1967 academic year accepted R & D teaching and administrative positions throughout the United States and in Brazil and Canada. Four postdoctoral fellows continued their prior positions or accepted new positions at Indiana State University, University of Colorado, University of Illinois, and University of Wisconsin. The entire staff of the R & D Center is involved in the continuous upgrading of its research and development capabilities through Center-supported seminars, colloquia, and workshops.

Projections

Most of the research and development activities currently fall into Programs 1 and 2. These programs will expand with much the same objectives as at present. Program 2 will probably require a larger share of the Center's resources than Program 1 since Program 2 projects tend to be oriented toward more expensive developmental activities. Program 3, Facilitative Environments, is projected as an administrative function after FY 69. The projection is that the environments will be maintained by the schools; thus further development and testing by the Center will not be required. More specific projections for Program 1 include the continuation of each current project through the formulation and testing of a relevant sub-theory or model in a school setting. The use of the computer in on-line research is projected for initiation in FY 69, and initial research on computer assisted instruction is projected for FY 70. Neurological - and pharmacological research on learning is under investigation as another Program 1 concern.

The projections for Program 2 include the continuation of each project through the development and testing of a relevant prototypic instructional system. The major efforts will continue at the elementary school level in reading, mathematics, and science. A project in social studies will be initiated in FY 69. The present speech and English projects are expected to terminate upon complete testing of the prototypic systems. Computer management of individually guided mathematics will be initiated in FY 69. In FY 70 computer management of the individually guided reading system is projected. The Center plan is to continue its efforts toward the improvement of elementary education until children of fifth grade age achieve at least a high as current sixth-graders in reading and other language arts, mathematics, science, and social studies. At that time, a decision will be made as to what can be done through R & D for further improvement in elementary education in comparison with potential benefits that might accrue from moving upward into the junior high school or middle school.

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RESEARCH AND DEVELOPMENT CENTER FOR EDUCATIONAL STIMULATION (3-12)

Warren G. Findley
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Rationale for the Center

American education is challenged by the demands of a world of increasingly rapid change. To date, the response has been largely to extend organized education farther into the life cycle for more and more individuals in an effort to increase by conventional instruction the reservoir of cognitive competence in American society. This approach has its limits and current campus revolts serve to underline them: simple prolongation of the adolescent-student status is insufficient and comes up against the need and desire to assume an adult role. One clear alternative is to start education earlier and intensify its impact by cumulative effects achieved through increased understanding of the amounts by which effective cognitive competence can be increased and the procedures through which maximum increases in such effective competence can be developed.

The Research and Development Center in Educational Stimulation at the University of Georgia accepts this alternative. By the same token, we reject a maturational view that waits for readiness for learning of various sorts to develop on schedule. Intellect develops in response to stimulation, so we plan to intervene to this end. We are encouraged by the recent writings of men like Bloom, Hunt, Hebb and Bruner and the related earlier and continuing work of Piaget on how the infant masters his world. An earlier start is in order. Bloom's findings that 50% of adult intellectual capability is defined by age 4 and 80% by age 8 have stirred us as well as others. Of course, the learning based on this intellectual development is achieved over a longer period, as he points out, but early stimulation of cognitive development is crucial. We take early schooling as the point of departure for this development.

An intensive cumulative follow-up of

whatever can be or is achieved early, through improvement of schooling in the lower grades, is equally in order. Here the findings appear to be that continuously adapted instruction can increase the early gains, while unimaginative reliance on present procedures in the schools rapidly dissipates the advantages of an early start. Lengthening the school year and school day in some measure should help if used imaginatively. In any event, there remains the opportunity to do better whatever we do for all children, whether they start schooling at an early age or at the conventional age of six. In the end, adolescents will stand better prepared to assume adult roles earlier with greater competence. Hopefully, they will take full advantage of opportunities for advanced education. Certainly, advanced specialization can come earlier for the many who will need it. But they will also be better prepared if they drop out at any stage, whether or not they return for further organized education later. The educational dollar will have gone farther in any of these eventualities.

Avowed Goals - In the original proposal for this Research and Development Center in Educational Stimulation, submitted December 1, 1964, three major objectives of its work were stated, as follows:

1. To probe the limits of cognitive, aesthetic, motor, and affective learning in children with the purpose of establishing new norms for learning, particularly cognitive learning;
2. To provide field tested structured material conducive to early and continuous stimulation; and
3. To disseminate research findings and materials to users as quickly and as widely as possible in such a way as to improve educational policies and practices.

The preceding ideas were synthesized and stated as an hypothesis thus:

> The *basic hypothesis* that unifies the whole program of activities of this Research and Development Center is that early and continuous intellectual stimulation of children, ages 3 through 12, through structured sequential learning activities will result in higher levels of ultimate achievement than would otherwise be attained.

To give further specificity to the aim of "higher levels of achievement", a two year increment was postulated. Thus, we proposed as a goal by which to succeed or fail in our longitudinal efforts that children who had started at age 3 and had been stimulated in continuous fashion by programs and materials tailored to fit their gains by prior stimulation, would by age 12 exceed expectations on appropriate standardized achievement tests by two years or two grades. Of course, this presumes the concurrent development by others, or by us, of measures needed to appraise important outcomes not currently represented in achievement tests.

Intermediate goals were set as follows:

1. By age 6, after three years of preprimary educational stimulation, children will exceed expectations on appropriate standardized achievement tests by one year or one grade.
2. By age 9, after an additional three years of primary instruction employing materials and methods sequentially related to their earlier learning gains, the same children will exceed expectations by 1.5 years or 1.5 grades.

It was recognized that attainment of the long-term goal of two years advance in the various competencies by age 12 could be expected only if early progress toward such goals was promising. Consequently,

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although persistence of achievement gains through age 12 is the fundamental criterion, appraisal of progress toward such goals needs to be made and reported at the intermediate check-points indicated. This requirement gives even greater urgency to the need for developing new procedures for validly appraising early progress. Hopefully, such instrumentation will keep pace with the development of instructional materials and procedures for stimulating cognitive growth at the preprimary level.

These successively more specific and more immediate goals of achievement need to be understood in a framework of combined urgency and impact which involves at least the following major theses:

1. The present need is for *generally* higher intellectual competence to operate successfully and happily in our rapidly developing technological society. Compensatory efforts for those culturally disadvantaged are important, nay essential, to make our goals of equal opportunity truly realizable, but the demand is broader. All children need to be helped to realize their potentials more fully, to raise maximum and intermediate, as well as minimum competence, so the thrust of the early effort needs to be not only continuous, but universal.
2. Starting *all early* in school not only tends to equalize the early stimulation of all children, now so uneven in our culture, but makes possible earlier the stimulation and motivation of the culturally limited child by his advantaged peers.
3. The effectiveness of early and continuous stimulation through schooling needs to be demonstrated not only longitudinally to show persistent effects, but in a total ongoing curriculum so that success in particular areas of cognitive development is not achieved at the expense of neglecting other areas of learning.
4. A central emphasis on cognitive development is essential, but is to be accomplished in a curriculum that takes account of young children's responsiveness to active, game-like approaches. What starts as fun, becomes satisfying in itself. "Play with an agenda behind it" gradually takes on any necessary work-study qualities. Side effects, favorable and unfavorable, are to be noted.
5. As intimated earlier, the appraisal of outcomes will require not only development of new measures for important outcomes currently not well measured, but reinterpretation of old, seemingly well-established instruments in the light of the new conditions created by systematic early intervention through schooling.

A brief historical footnote is in order here. The emphasis in the Georgia Research and Development Center on early schooling antedates the National Laboratory in Early Childhood Education, launched in 1967 with a National Coordinating Center at the University of Illinois and satellite centers at five other universities: Arizona, Chicago, Cornell, Peabody, and Syracuse. Moreover, Project Head Start got its start in the summer of 1965, a scant two months before the University of Georgia Research and Development Center in Educational Stimulation came into being. Our focus on ages 3-12 remains, of course, on the effects of stimulation via schooling throughout the pre-adolescent period.

Methods Used to Achieve Goals

A fundamental feature of the approach of the Georgia Center is the longitudinal study. If earlier schooling is good, it must show not only immediate, but persistent effects. Earlier than we had expected, it has been possible to launch schooling at age 3 for a cross-section of the children (60 per age group) of a suburban county with a mix similar socio-economically, ethnically, and in measured mental ability to the nation as a whole.* In addition, we have other public school populations of three-year-olds and five-year-olds in rural and urban settings, variously disadvantaged.

Experimentation in a bona fide field center, integral to a public school system, has disadvantages as well as advantages. The rigorous and systematic control which characterizes laboratory experiments of limited scope cannot be maintained. Even the collaboration expected of teachers in laboratory schools has to be sacrificed somewhat when teachers acknowledge a responsibility to the local school district for instructional service as well as experimentation. Personnel in the school system outside the instructional units engaged in the collaborative effort, both teachers and supervisors, exert an influence that complicates any field study, especially a longitudinal one. On the other hand, as indicated earlier, the stimulative approaches of this R & D Center need to be subjected to these hazards as an integral part of demonstrating their applicability to the problems of the schools. Also, efficiency is served by using a model that combines research interactively with development and field testing, with problems for research and/or revision emerging from the efforts at application of best thought based on past research and experience. Furthermore, the experience of full-scale field collaboration lends credibility to the end-products of early and continuous educational stimulation when these end-product approaches are described for possible use elsewhere.

Substantive Area Programs of Stimulation - The pattern established is of programs of stimulation related to curriculum areas, incorporating their own research and evaluation activities, in each of seven major fields: language arts, mathematics, science, social science, art, music, and physical education. (Three other programs cut across the several fields and will be discussed later.) Each program has a program coordinator from the appropriate teacher training department at the University of Georgia. Under the general direction of these coordinators, teams of professors and graduate assistants assemble or develop curriculum materials and procedures suitable for the several levels of the school in which they are to be used. These substantive area programs follow varying models. Gagne's model of hierarchical structure is followed systematically in science and mathematics, somewhat less rigorously in language arts and fine arts. On the other hand, the social science and history units imply no set sequence.

Presently, the chief emphasis is on preparing materials and instructional procedures for preprimary units. Since the first major bloc of three-year-olds entered the longitudinal study in the fall of 1966, they will complete the preprimary curriculum in May 1969. Two subsequent age cohorts of 60 pupils each will finish amended versions of the same curriculum in 1970 and 1971, by which time it is expected that programs of preprimary instructional units will have been developed, field tested and refined in the longitudinal groups, after pilot testing on a small scale in individual classes and/or concurrently with field testing with variously disadvantaged groups in the other centers.

Active liaison is being maintained with other research and development centers concerned with the learning of children and with the National Program in Early Childhood Education for research findings, tried materials and procedures, even collaborative studies of parallel approaches. Where arrangements can be made, strategies differing from our "separate disciplines" approach will be followed and evaluated in terms of comparable data.

Wherever possible, currently available curriculum materials are being adapted for use at earlier ages. But this adapting for the youngest children commonly involves breaking down units intended for primary children into smaller segments, or producing preliminary instructional material not generally required with older children. Consequently, the preprimary units have required and will continue to require considerable time in writing, field trial and revising during the next three years.

The several programs are at different stages of development, but all will require the full period of three years to reach satisfactory levels of refinement to warrant dissemination. In science, the parallel development of preprimary and primary sets of materials under a preconceived primary program, will result in parallel production of the materials by 1973 and 1974, respectively, rather than by 1971 and 1974, as in language arts, mathematics and social science. In art, music, and physical education, FY 1968-69 will represent their first year of operation; current plans call for instruction to begin at age 5 and extend to age 12, with instructional packages to be ready at the dates projected for the other fields, 1971 and 1974, respectively.

A Coordinator of Programs is to give the necessary leadership to assure that the seven program coordinators for the substantive areas of stimulation have the opportunity to share ideas and work toward an overall unified program. Regularly scheduled meetings of the substantive area coordinators are to be supplemented by individual consultations. In is way, it is hoped that the approaches in the various programs will be duplicative only by specific intention and that the maximum contribution to the development of generalized cognitive skills will be achieved.

Active dialogue between classroom teachers and the program coordinators will be fostered. This coordinator of coordinators will seek to see that allocations of time among the substantive areas of stimulation at various levels are reasonably balanced and do not place a heavy overload on a classroom teacher, and that all these activities are properly coordinated with the functional programs described below.

Functional Programs - Three programs cut across these seven substantive area programs: evaluation, influencing variables, and administration of continuous stimulation. They must be discussed separately.

The evaluation program has as its chief function the appraisal of learning outcomes at the natural check-points: age 6, at the transition between the preprimary and primary units; age 9, at the transition between the primary and intermediate units; and age 12, at the end of the intermediate unit. In addition, this program has responsibility for discovering or developing new procedures for supplementing standardized achievement tests. Further, there is the establishment of valid measures of some initial capacity of children as they enter the programs, entailing the evaluation and reinterpretation of standard instruments for that purpose. Finally, a special responsibility is the design of a data bank for retrieval of all accumulated evidence relevant to describing and evlauating achievement, including description of instructional input for each group of children studied. Special studies will need to be made of factors like length of school day and school year as the Center explores the full meaning of "continuous" stimulation.

Influencing variables is a term for a program of studies to determine the effects of personal, social and environmental variables on school learning. It is presumed that FY 1968-69 will be required to generate an integrated program of such studies. Present emphasis is upon such factors as logical reasoning and verbal mediation in improving learning. The interacting variables of concern are associated with the home and neighborhood on one hand, and with the teacher and other school factors, on the other. Several of these developments suggest increasingly close collaboration with the evaluation program. For example, parent and teacher styles of teaching, parent attitudes toward schooling, teacher-pupil interaction related to aggression-docility, are recognized sources of variation affecting learning, yet a major problem is developing valid and reliable measures of them for use in situations involving young children. Developmental scales, based on teacher observations of children's growth along significant continuums, are already in process of being developed jointly.

A major program is the design and trial of an organizational pattern for enhancing the continuous effect of stimulation. Adding on instruction at the end of an effective sequence presents unique problems. An approach we have been able to employ in some field centers is to keep the children in intact classes over a period of years. It remains to design a pattern for normal operational use in schools to facilitate maintenance of advantages gained from early stimulation by insuring that such children are advanced to classroom groups in which they will be given the further stimulation ordinarily given to those with similarly developed abilities. We are actively investigating a plan of achievement grouping, subject by subject, in a large consolidated elementary school to which children with preprimary experience in one of our field centers are promoted. Under this plan, much like Stoddard's Dual Progress Plan, the children will work with language arts teacher-specialists half the day and with teacher-specialists in the other several subjects the other half day in groups organized by level of achievement in each subject. Thus, a child may be in a more advanced group in language arts than in mathematics if his achievement in these subjects differs.

Supporting Programs - In addition to the normal supporting programs, are ones for dissemination and field centers. An intensive program of dissemination to major groups within the state has been effectuated and visits to the field centers have been a source of impact on thinking about preprimary education in the state. The 21st Teacher Education Conference at the Georgia Center for Continuing Education in January 1968 was attended by over 200 major educators in the state and heard several speakers from the Research and Development Center, among others, talk on early childhood education under the theme "The World of the Child". The major addresses of this conference constituted the substance of Volume 1, Number 3 of the *Journal of Research and Development in Education* this spring. Major accounts of the Center's activities have been presented at national meetings including those of the American Educational Research Association, the Department of Elementary School Principals, the Association for Supervision and Curriculum Development, and the Association for Childhood Education International. A motion picture film, in process of revision, is now available to help tell our story. Our curriculum materials for the preprimary level are scheduled for extensive trial in four centers of Project Follow Through widely scattered over the country.

The field centers program merits special mention because of its basic place in the operational structure of the Research and Development Center in Educational Stimulation. All our programs are being tried in ongoing school situations at field centers that offer a total curriculum to the children in attendance. Further significance is to be found in the fact that working relationships have involved an efficient symbiotic model for field centers in which the Research and Development Center has given leadership and consultant service to systems with Title I and Title III projects under the Elementary and Secondary Education Act of 1965, while the systems have in the process assumed large operational costs. In Clayton County and in Oconee and Oglethorpe Counties we have been associated with innovative programs under Title III broader in scope than our immediate interest, but focused enough to give us support. The same can be said of Title I collaboration and support in Athens and Gainesville, Georgia.

Accomplishments to Date

Present accomplishments may be stated in two chief ways: experience and findings relevant to development of programs of stimulation, and achievement data for those partially trained in the longitudinal study. The fact that these programs of stimulation are in process of continuous revision means a current lack of publishable materials. In-service training of teachers with these evolving materials gives hopeful promise, but little is sufficiently finished to warrant distribution. The narrative account which follows constitutes the most helpful current accounting of progress.

Development of Programs of Stimulation - Progress to date in the areas of language arts, mathematics, science, and social science indicate with varying precision structural sequences found effective at the preprimary level. In the language arts, work on the skills of word recognition and visual discrimination has yielded a tentative curriculum for those children who are given beginning reading instruction as early as age 3. In essence, this consists of introducing the child to the rudimentary understanding of basic conventions in reading - book, page-turning, front-back, top-bottom, left-right, return sweep, discrimination of letter and word fragments - so that he masters the nature and purpose of reading while still at the level of being read to. Sequence in "picture-reading" and anticipation of outcomes are other readying activities for the reading act.

Evidence from our own research studies of morphology in children's speech is being used to refine sequences for introduction of word recognition for fours and fives. Physical acitivity, even of handling and marking, is being found more effective than passive "sitting" type approaches at both levels. Classroom "exercises," like a hopscotch with words on the squares or dartgun shooting of words (on leaves) off trees, have this quality of activity as well as game motivation.

Integration into the total language arts program of oral language projects and prior developments in written composition in the English Curriculum Study Center (funded for 1963-68) are to be achieved as the program moves forward. Currently, the reading progress of each child is being made the basis for his spelling, his spelling lessons being mastery of words he has most recently learned to read.

In science, a "process" emphasis - observing, classifying, measuring, etc. - for ages 3 and 4 leads naturally into application of these processes in "content" settings in the more advanced preprimary and primary curriculum units. The AAAS "Science a Process" materials are being used as a point of departure. Five preprimary curriculum units were tried in two field centers in 1967-68 and will be retried in revised form in 1968-69 along with two additional units; four primary units are in process of preparation for first trial in 1968-69.

In mathematics, two parallel curriculum development projects are being conducted at different centers. One begins at age 3 and has further units under development for ages 4 and 5, starting with a posited hierarchical scheme of basic mathematical concepts. The second program starts with five-year-olds and seeks to "repackage" commercially available materials currently offered for use in first grade. A game-like mode of presentation and learning shows promise.

In social science, work to date has proceeded without adherence to a strict chronological sequence. Projects in economic concepts at grade 4 and programmed instruction in anthropology at grade 5, as well as development of a geography curriculum for K-3, have proceeded *pari passu* with exploratory trial of units on customs and local history at the preprimary level. Under the newly appointed program coordinator, a sequential curriculum beginning at age 3 will be developed, using a separate disciplines approach. As the language arts program is able to draw on the English Curriculum Study Center, the social science program is able to draw on the Elementary Anthropology Curriculum Project (funded for 1964-69) for materials developed and tested for grades 1-7, not only to provide a point of departure for preprimary instruction in that area, but as a model to guide development of new units of instruction in the other social sciences. Other commercially developed primary level materials for the social sciences are being given preliminary trial at preprimary levels.

Pupil Achievement - Present progress in the longitudinal study can be reported only for some who have had two years consecutive stimulation. Fragmentary findings on some with only one year of stimulation at age 3 or 5 can be added.

The first group to move from one year of preprimary instruction at age 5 to a second year of primary instruction at age 6 constitute a kind of front wave with minimum input. In both years, these children were receiving the first round of stimulations planned with minimum advance opportunity. Nevertheless, these children averaged a statistically reliable 0.2 grade ahead of their peers who lacked preprimary instruction, on the Metropolitan Achievement Test, Primary I Level, in word recognition, word discrimination, reading comprehension, and arithmetic concepts and skills.

Those completing two years of preprimary instruction beginning at age 3 and age 4, respectively, showed substantial achievement on the same test. The 59 who began at age 4 averaged just short of 0.5 of the year's progress for first graders on the national norms in regard to word recognition, word discrimination, and reading comprehension, and more marginal gains in arithmetic concepts and skills. Of this group of 59, 39 met the Durkin requirement of identifying out of context 18 of 37 words most common in basal readers, and all but 4 of the remainder fell at or above C level on the Metropolitan Readiness Test, indicating likely success in first grade reading. Of the 59 who began at age 3, a total of 14 passed the Durkin test, 8 who were encouraged by their teachers to attempt the achievement test averaged as well as the older group, while scores of the remaining 51 on the Metropolitan Readiness Test showed 21 already at the C level.

Another way of describing end-of-two-years reading achievement is in terms of progress through pre-primers, primers, and readers. As of May 1968 after two years of instruction at ages 4 and 5, these 59 children were distributed as follows: 10 in the first reader, 11 in the primer, 17 in the third pre-primer, 15 in the second pre-primer, and 6 in the first pre-primer. Thus 53, or all but 6, this year reached a level of mastery reported for only 49 of 60 after a single year of preprimary schooling as five-year-olds in 1966-67. The 59 children with two years instruction at ages 3 and 4 were distributed thus: 2 in the first reader, 6 in the primer, 5 in the third pre-primer, 28 in the second pre-primer, 17 in the first pre-primer, and 1 still in the readiness materials. Again, 41 of the 59 past the first pre-primer compares with 24 of 60 who completed only one year of preprimary schooling as four-year-olds in 1966-67.

It must be repeated that the data presented above are based on only limited exposure to the program in its initial stages of development and with measures designed for use with older children. They are offered as hopeful indications of what may be expected when a full, tried program is in use. However, only after the full sequence has been carried through in 1969, 1970, and 1971 will we have a series of approximations to what can be done with a full program of successively refined materials. At that point, a much stronger showing must be achieved if we are to continue to entertain the likelihood of attaining our long-term goal of two years' advancement by age 12.

Estimate of Projected Success

Like all mature students of human problems, scholars and pragmatic administrators alike, those responsible for the Research and Development Center in Educational Stimulation at the University of Georgia are naturally hesitant to make strong predictions of future outcomes. Yet the investment of time and money involved necessitates positive assumptions of a substantial nature. So, with proper humility we offer our motivating expectations.

In the estimation of projected success the evaluations of pupil achievement play a dual role. Not only do we predict that measured student success in mastery of cognitive goals within the school environment will indicate the value of the total program, with its developed materials and procedures. At one and the same time, the developed evaluation procedures will become an integral part of the product for dissemination to those who would use our curriculum approaches, so that they may judge their success through their students' success in mastering the cognitive tools of living.

In particular, we hope to present a systematic analysis of the value of various standard instruments, like the Stanford-

Binet and the Peabody Picture Vocabulary Test, as well as new instruments we and others may devise, for setting expectations at early ages of what children may attain at ages 6, 9, and 12 on achievement measures. These predictive studies will be discussed not only in terms of limited expectancies under ordinary conditions, but increased expectancies under modified conditions. New achievement measures will be adopted, adapted, or devised to appraise cognitive outcomes in the form of logical and coping skills not currently measured by published tests, as well as instruments growing out of the needs and experience of the curriculum area programs. A particularly promising approach is through systematic retrieval of teacher observations by interviewing teams. A broad variety of standardized test goals can, of course, be measured by presently available instruments.

The program on influencing variables may be expected to contribute evidence on the influence of environmental variables, particularly those associated with the home. To the degree that funding permits, studies of home interventions will be included and reported as they affect the learning programs. Teacher variables of personal style will be included as descriptive information associated with reported learnings if more refined inferential conclusions are limited. All these data on home, teacher, and other background variables will be incorporated into a data bank with pupil characteristics and achievements, records of instructional programs, school organization patterns, and length of school day and year, to provide the basis for comprehensive evaluations of these variables and their interactions on learning achieved. Methods of statistical analysis possible will extend to multivariate analysis. Establishment of the data bank promises the necessary basis for analysis of interactions of variables from different stages of children's school careers.

We see as a feasible goal the development of a plan of teaching children in school from an early age that is an integral part of their total schooling. As with all dynamic systems, schools will continue to change, so our solution can not be a static one. Rather, it must be related not only to schools as they have been and are, but to schools in various stages of becoming adapted to new demands. Variations in the length of the school day and school year are clearly to be anticipated. Our own studies involving these variables should prove instructive to others.

We are currently caught up in the problem of providing for transition in our own field centers. These centers provide a realistic laboratory for designing adaptable organizational patterns for more general use. Clearly emerging is the fact that introduction of early education into a school system by adding schooling onto the front of the standard educational process creates unique problems unlike any that may result from adding at the end of the process. The later may retroactively affect earlier features but ordinarily only to a limited degree. Students have gone on to further study in the past; newer and larger opportunities to go on have enabled students simply to achieve greater individual heights from the standard base. Adding at the beginning, however, establishes a whole set of new bases. When growing numbers come with earlier schooling to "first grade," the established practices of good teachers for inducting literal "newcomers" into the standard system of schooling have to be more than adapted moderately. The entire institution of schooling has to undergo transition. Institutional change of this fundamental nature will necessarily involve some compromises and adjustments until earlier schooling becomes institutionalized at a new starting point for most children and most systems. Whatever emerges as a common denominator of early schooling will do so to the accompaniment of new methods of institutional organization and substantial in-service teacher training. Our field centers represent urban and rural situations for continuous investigation of the problems of transition.

By 1971, under a coordinated regimen of interaction among the curriculum area program coordinators, a first approximation to a suitable preprimary program will be ready for general dissemination, having been worked over each year in the light of the field testing experience of that year and of accumulated knowledge drawn from active liaison with other studies. It will be a guide based on the premise that there is a place to begin in each curriculum area in relation to the others and that progress from that point will depend on the age of introducing the program (age 3, 4, or 5) and the efficiency of teaching and learning in the local situation. It is quite likely that the amount of content in each curriculum area dependent on reading will be geared to its compatibility with the time and process required to teach the reading act. Thus, numbers of units in natural science and social science will be elective, dictated by evidence of effectiveness in our field centers under varying conditions, by the beginning age of a school system's preprimary effort, and by local preference. Evaluative procedures will be keyed to the units in the several curriculum areas, including observational procedures and product evaluations, as well as test exercises or task evaluations. The interaction of influencing variables will also be included as warranted by findings.

A fundamental contribution we trust will be an account of how to adapt this early schooling approach to ongoing procedures. This will need to be of two sorts: (1) how to adapt the organization of the local elementary school to enhance the further progress of these early learners, and (2) how to smoothe the transition for any of these children whose family mobility may bring them into other school systems. The current experiment in achievement grouping is only one possible approach to the first problem. We shall remain alert to other administrative devices to try. Our packaged product will include a distillation of our own evaluated experience and reports of others. The transition to other systems will require the designing of a report, with supporting evidence, of each child's status with respect to school learnings, couched in terms conducive to constructive reaction by the school to which the child is transfering. There will be ample opportunity to refine this procedure year by year.

Pupil evaluation we have said will describe the ultimate effectiveness of our version of early schooling. The goals to succeed or fail by that were reported at the beginning (one year by age 6, 1.5 years by age 9, and two years by age 12) are based on gross estimates of the amount of effect required to justify the cost of early education. We still hold to these goals as practical until tested. Cost-benefit evaluations of their worth, however, will be a part of the ultimate evaluation. But this becomes complicated if indirect social benefits are included. The roles and costs of many kinds of aides, for example, will have to be worked out. The social value of useful employment vs. welfare support is a complicating factor. Nevertheless, as the experiment progresses, the costs associated with each group's early education can be computed and related at least to measured outcomes in school achievement. All may then judge the amounts of the learning gains and enter upon the assessment of their social, as well as economic value.

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FILM

Educational stimulation in the pre-school years.

CENTER FOR RESEARCH AND DEVELOPMENT FOR TEACHING

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CENTER FOR RESEARCH AND DEVELOPMENT IN TEACHING

Robert N. Bush and N. L. Gage
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The Stanford Center for Research and Development in Teaching began its work in September 1965. A part of the School of Education, it provided a new setting for collaboration among professional educators and behavioral scientists. Its aim, as stated in the original proposal, is "to improve teaching in American schools."

The Center's Evolving Goals

In this effort, we distinguish between *teacher effects* and *teacher education.* Teacher effects refer to relationships between teacher behaviors and characteristics (independent variables) and pupils' achievement and changes (dependent variables). Teacher education refers to relationships between teacher behaviors and characteristics (dependent variables) and teacher education programs and procedures (independent variables).

Using the above distinction, the Center originally grouped its research efforts in three "domains" of variables: the *behavioral,* the *personological,* and the *institutional.* These terms denote events that occur at increasing "distances" from the point of impact of the teacher on his students in the classroom. The *behavioral* domain refers to those variables which deal with the observable, objectively describable behaviors of teachers and pupils in the classroom. *Personological* variables are traits and characteristics of teachers and pupils, not directly observable in the classroom but rather inferred from responses to tests, inventories, and rating scales. Teachers' attitudes, values, cognitive abilities and styles, traits, and characteristics are all variables in the personological domain.

The Center has been concerned with how the role of the teacher is being affected by social and technological changes and by the social and administrative forces in the school district and the individual school. These changes and forces constitute the *institutional* domain. The Center has examined the organizational context of teaching, the professional socialization of the teacher, and other aspects of the institutional setting.

During the academic year 1967-68 the Center reformulated its programs and goals. Three major problem areas were defined, stemming in part from previous research of the Center. The first problem area, *heuristic teaching,* reflected an urgent demand for more effective and informed teaching and a more precise definition of the teacher's role in the context of social and technological change. We see heuristic teaching as teaching aimed at developing self-motivated and sustained inquiry, emphasizing affective as well as cognitive processes, and placing a high value upon the uniqueness of each pupil, teacher, and learning situation. It is contrasted with didactic teaching, in which the teacher dispenses information to passive pupils. The term "heuristic" connotes only a part of what we see emerging, but we have not yet been able to find a better single term for the cluster of questions we wish to investigate.

The second problem area, *the environment for teaching,* derives from our conviction that schools must be so organized and operated as to permit a new kind of teaching and learning to take place. Schools as now organized tend to discourage the kind of teaching and learning we have called heuristic. We are asking how the learning environment can be modified in the direction of the "open" school, defined later in this paper.

The third problem area, *teaching the disadvantaged,* arises from the urgent needs of the poor of our cities and certain minority groups. It would be foolish to blame the schools alone for these problems or to expect them alone to reduce their severity. But the Center's program in this problem area will seek to determine how the concept of heuristic teaching, applied in the environment we call the open school, can help contribute to overall solutions.

Research Efforts at the Stanford Center

The scope of the Center's research is perhaps best shown by describing individual projects and investigations within the framework of the domains and problem areas sketched above. The following account summarizes the Center's past, present, and future as of July 1968.

The Behavioral Domain

1. *An Overview of Research on Teaching*

An obvious need in the early stages of the Center was a survey of current literature which might have relevance for the Center's researchers. The resulting paper (Gage & Unruh, 1967) dealt with the proposed revolution in teaching ("describing" vs. "improving" in research on teaching; two convergences on conceptions of teaching), models of the domain of research on teaching, the relation of theories of teaching to theories of learning, the need for synthesis, and views on promising directions in research on teaching.

2. *Studies of Microteaching, and Training in Technical Skills of Teaching*

Microteaching grew out of a technique being developed at Stanford when the Center began. It is a scaled-down teaching exercise, wherein the trainee teaches a lesson of about five minutes to a small group of pupils, typically about five in number, and attempts only a relatively specific aspect of the teacher's task, such as making an assignment, using a visual aid, handling a discipline problem, or engendering a cognitive set. Microteaching is "real" teaching in that the pupils are not actors and do not hear the same lesson twice. After the trainee has taught the lesson, he views a videotape recording of his behavior which he discusses with a supervisor trained to make helpful and tactful suggestions. Then the trainee immediately reteaches the same lesson to a different group of pupils and also repeats the cycle of discussion and criticism while observing the new videotape recording. The technique has been used extensively with students preparing for internship at the secondary school level in the teacher education program of the Stanford School of Education.

One key aspect of microteaching–the selection of a small, identifiable, specific sequence of teaching behavior–led to a more general concept: "technical skills" in teaching, or specific teaching behaviors that are used in a variety of teaching situations and are to some degree independent of the subject matter or the kinds of students being taught.

The long term goal of the Technical Skills project has been to define a set of skills making for effective teaching; to determine the effects of these teaching behaviors; and to determine how to train teachers to use these skills. The dependent variables are thus the specific technical skills desired; the independent variables are training procedures, such as modeling and feedback.

Implicit in this research is a certain conception of teaching style. We have been most interested in those behaviors least likely to be reproducible by nonhuman means such as texts, films, television, and computers. We see the teacher as a stimulator of inquiry and a guide of self-directed activity. This concept of teaching will be recognized as part of what we have termed "heuristic" teaching.

The research has been carried out in connection with the secondary teacher education program at Stanford; the interns in this program thus serve as "subjects" both for the experimental studies of technical skills and for studies aimed at improving or modifying the teacher-training program at Stanford. Three broad categories of variables have been manipulated: (a) the *demonstration* component of teacher training (various kinds of instructions or performance models); (b) the *conditions of practice* (variations in the amount and timing of interns' practice and in the choice of lessons); and (c) *feedback arrangements* (viewing of videotapes of teaching performance, with variations in the cues by which the subject is helped to analyze his behavior).

Following are some of the hypotheses or conclusions which have emerged from the technical skills work:

1. For initial learning of a complex teaching performance, where the trainee teaches the same lesson as the model, a preferred strategy is to show a model performing the desired behavior, but with no non-instances of the behavior in the model tape. A second learning trial, using both instances and non-instances of the desired behavior, then introduces discrimination training.
2. Students who first taught one lesson and then taught a different lesson showed a marked decrease in performance.
3. Two training conditions were found to be particularly effective: (a) a combination of perceptual modeling (videotaped model of a teacher performance), positive instances only, followed by teaching the *same* lesson as

that demonstrated; (b) symbolic modeling (written description of a lesson) with instances and non-instances of the desired behavior, followed by trainee's teaching his *own* lesson.

4. In the development of "inquiry questioning," models of pupil responses to teacher behavior were more likely to be effective than models of teaching behavior.

5. A general hypothesis emerging from the technical skills research is that negative instances or non-instances of the desired behavior are effective only when they can be used in a discrimination-training strategy. These results seem to accord with a body of psychological literature that encourages instructors to avoid inducing learning by indirect means, except when such learning can be linked to ways of finding the patterns of the behavior to be learned.

6. If the trainee, while viewing a videotape of his performance, is systematically cued to look for specific kinds of behavior to be learned, his learning is likely to be improved. But cueing during a feedback session (as distinct from a modeling session) added nothing to the improvement in performance. This experiment leads to the hypothesis that when effective cueing can be provided during a *modeling* session, it is not necessary to add the cueing component to the *feedback* session.

Two related investigations, whose data have not yet been fully analyzed, deal with the interaction between training-method and the technical skill being learned. An experiment at Stanford used three types of training conditions: (a) symbolic modeling (transcript of a lesson); (b) perceptual modeling (videotape of the same lesson); (c) a brief written description, which the trainees read, followed by their own teaching and subsequently by feedback with an experimenter present to analyze their teaching performance. Three different technical skills (reinforcing students for participating in class discussions, probing, and the use of silence and non-verbal cues to stimulate discussion) were learned on three successive days. An experiment at San Jose State College, with elementary school interns, applied two treatments (modeling with and without an experimenter present) to the learning of the three skills just cited. The effectiveness of the treatments will thus be tested across the learning of three different skills.

Trainees in the above experiments have exhibited differential reactions to treatment, such as positive and negative emotional reactions. They have also seemed to demonstrate different cognitive strategies and capacities as they viewed model or feedback videotapes. Studies are under way to determine how such characteristics interact with kinds of treatment by investigating possible relationships between trainees' scores on perceptual and verbal ability measures and the kinds of models (perceptual or symbolic) presented. This line of inquiry is related to the aptitude-treatment interaction studies described below under Heuristic Teaching.

An important element in the project has been the attempt to follow up the training program by examination of the trainees' behavior after a full year of teaching. Videotapes of microteaching sessions at the beginning and end of the Stanford secondary interns' summer 1967 training period, and at the end of their full year's teaching in 1968, have been combined with test data and are being examined to discover possible effects of the Technical Skills project.

An interesting extension of microteaching and the technical skills approach is called "learner-monitored teaching." Equipment providing for immediate audio and visual feedback in various possible combinations during a teaching session has been designed and in part constructed. Through a master control station and learner satellite stations, the teacher-subject may receive predetermined comments or specific inquiries and reactions from both pupils and observers.

The Technical Skills project has resulted in production of a 30-minute color film, "The Technical Skills of Teaching," in which the concept is explained and demonstrated.

Papers resulting in whole or in part from the project include McDonald (1968a and 1968b), McDonald & Allen (1967), and Orme (1967).

The Technical Skills project will continue as a project on Training Studies within the new problem area of Heuristic Teaching. Further investigations will concentrate on the technical skills which are or seem to be directly related to eliciting complex, inquiry-oriented pupil behavior.

3. *Technical Skills of Teaching: Explaining*

The "effectiveness" of teachers in presenting explanations or lectures to their classes has been an area of investigation. This project was based on the assumption that the explaining aspect of the teacher's role will continue to have some significance despite the increased use of various media other than the teacher (television, programmed instruction, films, and the like) for didactic instruction.

Four studies, based on the same set of data, were completed and described in a symposium on "The Teacher's Explaining Behavior" at the February 1968 AERA meeting. The first study (Belgard, Gage, & Rosenshine, 1968) indicates that the teacher's ability to explain does not depend entirely upon the particular lesson being taught on a particular day to a particular group of students, and that students' ratings of various dimensions of their teacher's performance correlate substantially with how much they learn from that performance. Unruh (1968) found that videotaped lectures provided more valid cues than typewritten transcripts, transcripts combined with videotapes, audiotapes, or both, or audiotapes and videotapes combined. The most important correlates of effectiveness, as measured by adjusted mean comprehension scores, appeared to be student-rated teacher preparation and presentation, the cognitive level of the presentation, use of an outline, and coverage of the material. Responses relating to personality variables and vocal quality did not discriminate. These results should be useful in the search for less subjective and perceptual, and therefore more objective and behavioral, correlates of effectiveness.

Rosenshine (1968) found four of 72 variables which discriminated between high- and low-scoring teachers, as measured by their students' adjusted mean achievement scores. These were (a) rule-example-rule-pattern, (b) explaining links, (c) gesture, and (d) movement. Dell & Hiller (1968) used a computer to count kinds of words appearing in the transcribed protocols of the teachers' explanations. High negative correlations between "vagueness" (words such as *almost, generally, many, maybe,* and *most)* and effectiveness were found. Explaining links correlated .37 and .38 with effectiveness.

To the extent that lecturing or verbal exposition forms part of any classroom situation, the above findings should have relevance in determining the kind of explaining behavior found most effective.

4. *Role-Playing in Teaching Decision-Making Skills*

The impact of role-playing on the cognitive and affective life of the learner, and its implications for teacher training techniques, have been an area of investigation. The data have been collected and are being analyzed. Meanwhile, a training seminar in role-playing is being conducted with a group of secondary interns, and documentary and training films have been made.

Further work will be carried on in the new program on Teaching the Disadvantaged described below.

5. *Teaching in Small Groups*

An early assumption by the Center was that interpersonal relationships, and specifically working with pupils in small groups, will play an increasingly important part in the definition of the teacher's role. Three lines of inquiry have been followed.

An experimental training program at Stanford for a group of 26 secondary English and social studies teachers was one line of inquiry. Follow-through was provided by verbal reports on the teachers' perceptions of the small group classes they themselves conducted the following fall and by videotape recordings made in the classes of teachers who had and had not participated in the workshop.

Experimental training programs with Stanford interns have provided the means of investigating the kinds of learning experiences within a conventional class (lectures, discussions, reading, and reflective writing) and in a "human relations" approach to teacher training. Data reduction and analysis are in process.

An experimental course using a laboratory approach, focusing on the classroom as a group with its own norms, values, and status systems, was developed. The subject matter of the course thus examined the behavior of its students as well as the "established knowledge" about teacher-student classroom interaction. The course was designed to be self-evaluating: in analyzing the data, the students learned something about empirical evidence as well as group life in a classroom situation.

Small group research will continue within the new Heuristic Teaching program and later in the program on Teaching the Disadvantaged.

6. *Teaching for Divergent Thinking (Effects of Computer-Assisted Instruction)*

The effects of computer-assisted instruction have been of interest to investigators concerned with teaching for divergent thinking. A study of first graders receiving reading and mathematics instruction by CAI and by conventional instruction was conducted. (Sears & Feldman, 1968). The results showed a significant effect from fall to spring; the CAI group started higher than the non-CAI in social behavior scores but declined, while the non-CAI group increased over the year in social behavior scores. The relationships between IQ, reading, and mathematics achievement test scores, and achievement as measured by a standardized test and by progress on the computer differed in interesting ways for the classroom and CAI groups. Normally, one expects achievement and academic variables to be correlated. The CAI treatment, designed to individualize instruction, appears to have reduced these relationships.

7. *A Taxonomy of Teaching Behavior*

A pool of items designed to serve as a behavior-descriptive system was developed and categorized. The initial pool was based on a review of existing observational instruments; additional items were written to fill in gaps. A computer-based system was developed to facilitate the use of the item pool. A category generator program is used to structure the entire pool or subsets of the pool according to any category system supplied by the investigator. A rating form generator program is used to prepare rating forms for the supervisors of the Secondary Teacher Education Program.

The system will be utilized in connection with the Intern Data Bank (described later in this report) and other research as it is relevant.

8. *Photography of Attending Behavior*

Time-lapse 35mm photography has been used to collect and analyze data on the attending behavior of students in their classrooms. Filmstrips of intern teachers and their classes have been developed. Rank-difference correlations among three measures of attention in nine classes were identified.

9. *Uncertainty Studies*

There are theoretical grounds for believing that uncertainty–the recognition of ambiguity or of alternative goals and solutions–and "uncertainty behaviors" underlie inquiry-oriented thinking and other complex cognitive processes. An early study indicated that lower-class children (grades 1, 2, 4, and 6) had difficulty both in generating and in using constructive alternative solutions to problems, and that an apparent increase in curiosity at the second-grade level did not continue to develop.

Children are often inappropriately certain of their answers; the expression "secondary ignorance" was coined to denote this phenomenon of one's not knowing that he does not know. Ways of teaching children to recognize when alternative answers exist have been investigated and reported. (Sieber, 1968b) One aim of this project is to improve understanding of the ways in which secondary ignorance, or inappropriate certitude, is typically expressed in various contexts, and to provide teachers with examples of inappropriate certitude and methods of teaching students to generate and handle "subjective response uncertainty."

This research line will be continued in the program on Heuristic Teaching, with obvious implications for the program on Teaching the Disadvantaged. New lines of inquiry are described later in this report.

10. *Effects of Anxiety Upon Intellectual Processes*

In a project on the determinants of complex information-processing behaviors in children, the relation between anxiety level and failures in problem-solving strategies in fifth- and sixth-graders has been investigated (Sieber & Kameya, 1967; Sieber, 1968c). Two forms of experimental intervention to reduce anxiety or encourage its facilitating effects were tried: (a) provision of memory support, and (b) brief training programs designed to reinforce attention to problem-relevant stimuli and to stimulate encoding and evaluation of such information. Preliminary results on the memory-support portion of the experiment suggest that the interference of anxiety with short-term memory could be offset by a variety of external aids such as diagrams or notational systems which problem-solvers could be taught to use. Further research includes a study of the effects of anxiety, IQ, and task difficulty on concept formation with and without memory support.

11. *Computer-Assisted Instruction in Teacher Education*

Ways of using computer-assisted instruction (CAI) in teacher education have been investigated. In instruction on a statistical procedure for processing test scores of students, a classroom group scored higher (though not significantly) on a criterion test than did the computer group. A group which proceeded through the program in a standard, linear manner scored higher (again, not significantly) on a criterion test than did a group allowed to make greater use of the flexible, branching capabilities of the computer.

The projects described above deal with behavioral variables having general application in the teaching process. The following two projects have concerned themselves with the development of technical skills as they apply to the teaching of specific subject-matter areas.

12. *Technical Skills of Teaching: Foreign Languages*

This project aims at improving the training of foreign language teachers by (a) producing materials and programs to train, and instruments to evaluate, foreign language teachers, and (b) studying characteristic classroom behaviors of good and poor language teachers identified in terms of their effects on pupils.

Three publications have been produced (Politzer, 1966a, 1966b; Politzer & Bartley, 1967). The procedures outlined in these publications were based on the general research in microteaching and modeling. The subsequent phase of the project establishes the reliability of the rating instruments and, above all, their validity in terms of the study of the effects of teachers on pupil attitude and achievement.

A pilot study dealing with the change of pupil attitudes yielded the somewhat disturbing result that teachers rated high in the performance of certain skills tended to have a negative effect on pupil attitude toward the subject (Politzer, 1967).

In the basic study, videotapes were made of 15-minute segments of the teaching performance of a group of French teachers. Criterion measures of speaking, listening, and writing in French were later administered to all pupils. An instrument for rating teacher-student interactions was developed and applied. Preliminary results indicate that teachers whose pupils were on the whole more successful (as measured by achievement) showed a significantly higher proportion of relatively uncontrolled to strictly controlled classroom interaction than did the teachers of the less successful pupils.

Work on foreign language teaching will continue under the new focus of the Center, concentrating on the problem of teaching the disadvantaged. The research will investigate the problems of transferring experience gained in teaching a second language to the teaching of the "second dialect" represented by the language used in and beyond the school.

13. *Technical Skills of Teaching: Social Studies*

This project investigated use of videotapes in conjunction with a course in social studies teaching methods. A Social Studies Teacher Appraisal Guide was developed. Copies of some of the videotapes have been prepared for local school systems and for the staff college of the U. S. Army Civil Defense School. The project has been described at meetings of social studies leaders and teacher educators and in articles for educational journals.

The Personological Domain

1. *Teachers' Attitudes and Their Correlates*

An early Center project was aimed at developing methods for determining causal relationships between teachers' attitudes towards pupils and pupils' attitudes towards their teachers (Yee & Gage, 1967). A second project, a study by means of diagonal factor analysis of a 100-item inventory of pupils' perceptions of their teacher, was aimed at determining whether five a priori categories of teacher merit (cognitive, affective, disciplinary, motivational, and innovative) would be supported empirically (Zwirner, Beck, Cronbach, & Gage, "Pupil Perceptions of Teachers': a Factor Analysis of 'About my Teacher," tentatively titled and in preparation). A further study investigates relationships between scores on the a Factor Analysis of "About my Teacher" tentatively titled and in preparation). A further study investigates relationships between scores on the California F Scale and Kerlinger's Educational Scale 7 and teaching interns' use of inquiring questions in the classroom in the early stages of their teaching.

The Center has developed a collection of research instruments for the measurement of teacher personality and characteristics. A 300-item Educational Opinion Inventory was administered to some 160 Stanford interns, and will be factor analyzed. Further work on the validation of teacher personality and characteristics against classroom behavior is being carried out.

2. *Teachers' and Students' Cognitive Preferences in Mathematics*

Recent research has given much attention to the existence of "cognitive styles." A Cognitive Preference Inventory was developed to identify possible differences in cognitive preferences of both teachers and learners, and their possible interactive relations (Travers, Heath, & Cahen, 1967). In this instrument each of 30 mathematics concepts is expressed in three different ways: verbal, symbolic, and graphic. One study indicated that both teachers and students of mathematics most often preferred the symbolic option. A further study presently under way will have as independent variables teaching mode, the verbal-symbolic-graphic distinction, and the student's preference for mode of mathematical expression, with pupil achievement as the dependent variable.

3. *Pupillometry in the Study of Teacher Attitudes*

Recent findings suggest that interesting visual stimuli and mental activity in arithmetic problem-solving produce pupillary dilatation. Research at the Center is intended to apply this finding to education.

A photographic pupillometer was designed and completed. Certain theoretical issues involving the nature of the visual stimulus presentation were developed. Techniques for scoring and analyzing pupillometric data were incorporated into two computer programs using inputs from the high speed optical scanning of photographic film. A detailed survey of the literature is nearly completed. Several pilot studies were made and are in the last stages of data analysis. One study was presented at the 1968 AERA meeting (Koff & Hawkes, 1968b). Other reports are in preparation.

The project has collaborated with Center and Stanford staff in several other areas of research. A study of "Structural and Interpersonal Components of Teaching Style: a Study in Pupillary Response" has been made; the analysis of the data is nearly completed.

The difficulty of measuring and controlling for a wide variety of compounding effects means that much additional basic research is necessary before the generalization can be made that change in pupil diameter indicates interest, attention, or cognitive complexity.

The Institutional Domain

1. *The Organizational Context of Teaching*

In an effort to identify organizational elements which influence the decision-making behavior of classroom teachers, extensive interview and questionnaire data from 16 elementary and 16 secondary school teachers, drawn equally from conventional and modified schools and from first-year and experienced teachers, were collected and analyzed. Tentative conclusions, which will be useful in further research, are summarized in the Center's First Annual Report (1967).

Another study dealt with the problem-solving efficiency and style of teaching teams organized with and without designated leaders. The teams were asked to solve the same two problems under standardized directions and time limits. The work sessions of each of these groups were recorded on audio tape. Additional information was gathered from each teaching team on its members' perceptions of the way in which they carried on their team work, attitudes toward their team experience, and preferences for assignment in the next school year. The data are undergoing final analysis. A second phase of this project will compare the decision-making efficiency of teaching teams with that of individual teachers.

2. *The Professional Socialization of the Teacher*

This project aims to identify and examine factors that affect role expectation and commitment in teaching and influence career mobility. Questionnaires were administered to one school district's approximately 1200 teachers; a modified version was administered to administrative and counseling personnel in mid-year. In analyzing the data, the project staff will look for changes in the attitudes and expectations (with particular emphasis on the perceived characteristics of the successful teacher and on role definition and expectations) of inexperienced and experienced teachers and of administrative and counseling personnel.

Further work on professional socialization of the teacher is described in the section on Environment for Teaching.

3. *Occupational Attitudes of Teachers*

The purpose of this project is to investigate the formation of occupational attitudes among teachers, their relation to dominant social values, and the consequences of group differences in such attitudes. Pretesting has been completed on a 60-item scale with the following occupational attitude dimensions: conformity, creativity, social contributions, financial reward, status, and security. The items are currently being revised.

4. *Case Studies of Teachers in Open and Closed Schools*

Innovations in structural arrangements,

teaching responsibilities, scheduling provisions, and pupils' class assignments are widely considered to make school experience more meaningful for teachers and pupils. Evidence is being accumulated about teacher behaviors that are modified by such innovations and those that are not. The data gathering began with a case study of a school with a traditional structure and organization. Particular emphasis has been given to the teachers' patterns of interaction with others, with teaching seen as a series of social encounters whose significance varies according to the activity base of the encounter, the population involved, and the physical setting.

In the 1968-69 year, the project will expand the study to include a more innovative, or "open," school. If possible, the study of the original traditional school will be continued to take advantage of a forthcoming shift in its pupil population and socio-economic background.

5. *The Teacher in 1980*

An early concern of the Center was a broad study of the future role of the teacher, in the course of which extensive interviews, seminars, and panel discussions on the topic were conducted. A thorough review of the subject will appear as a research memorandum.

It has become clear that the entire orientation of the Center is toward determining the role of the teacher in a period of heightened social and technological change. Accordingly, "The Teacher in 1980" has been terminated as a separate project.

Heuristic Teaching

We turn now to consider the work being conducted under the Center's new problem-area focus. Much of this work is a logical extension of projects begun under the previous formulation and has been described earlier in this report. Here we attempt to complete our description of the present status of the Center's research and development on the crucial problem of heuristic teaching.

1. *Training Studies*

Research on the technical skills of teaching is continuing, with emphasis on the skills most directly related to eliciting complex, inquiry-oriented pupil behavior. Modeling and feedback variables will continue to be manipulated. The new research will emphasize training in combinations of skills; pupils' question-asking as a function of the teacher's modeling and reinforcement; and pupils' question-asking over a series of lessons.

2. *Aptitude-Treatment Interaction in Heuristic Teaching*

One of the Affiliated Projects of the Center has been a study of interactions between aptitudes and instructional treatment variables. Included as "aptitudes" are characteristics and styles of both teachers and learners. The teacher's characteristics and styles of teaching can be investigated both as aptitudes with respect to teacher training programs and as treatment variables that interact with student characteristics and styles of learning (aptitudes) in producing student achievement.

Two studies, with particular implications for heuristic teaching, will be conducted. The first of these will examine extemporaneous and heuristic aspects of teaching and learning in closely controlled teacher-pupil dialogue situations, so that important stylistic variables can be defined and related to other aptitudes of teachers and learners. A second study will investigate interactions in complete classrooms. Evidence from earlier studies indicates that the correlations between student aptitudes and student achievement may vary systematically according to the characteristics and styles of their teachers. Such relationships cannot be elucidated from the measures of *average* class achievement. This second study will seek to identify positive and negative correlations between teacher aptitudes and treatments and student aptitudes and achievements. It is hoped that these and other studies will elaborate a more differentiated view of teacher training and teacher roles and will suggest additional teaching skill variables for development.

3. *Uncertainty Studies*

Preliminary research and theorizing has identified a number of cognitive skills which underlie learning to avoid premature judgments and to make correct use of available, although often disorganized, information. Ways of teaching these behaviors will be investigated.

A first and exploratory study will examine the degree to which uncertainty behaviors are found in lower-middle-class fifth-grade children and the extent to which these behaviors can be taught to such children. A second will be a two-year experiment adding new variables and covering grades 1, 4, 8, and 12 in middle- and lower-class schools. A third study will deal with the acquisition and use of uncertainty skill by teaching interns.

In recent research, preliminary results indicate that accuracy of estimation of subjective response uncertainty is a generalized trait across tasks and is uncorrelated with divergent thinking ability. Another study found a significant interaction of task structure and task definition in producing differences in subjective response uncertainty. While nonstructured films were found to increase subjective response uncertainty under instructions to generate diverse hypotheses, structured films were superior in production of response uncertainty under cue-attendance instructions. A "surprisal" measure of the information value of a particular response or group of responses was devised; this measure was used in a study which confirmed the interaction between stimulus structure and learning task.

4. *Experiments on Heuristic Behaviors in Disadvantaged Children*

Three experimental studies with disadvantaged children are in process. One study will examine the assumption that middle-class children are rewarded for and readily learn task persistence, while minority youth are impulsive in a way that interferes with it. If such a difference is found, it may be important to seek to improve persistence. The study will assess the effects of self-reinforcement on task persistence, the relation of expectancy of success to self-reinforcement, and the effects of task persistence itself on achievement. A second study will test the effects of modeling treatments on a child's learning to admit the existence of ambiguity. Lower-class children will observe models of other children expressing doubt in ambiguous problem-solving situations. The effects of being exposed to these models, presented on videotape, will be tested. A third study stems from the hypothesis that many minority-group children respond impulsively partly because of their relatively poor information-processing capacities and are rewarded for over simplification of discriminative perceptual and cognitive processes. Variables will be manipulated to see if such children can be helped to learn to control their impulsivity by teaching careful cue discrimination, or by simply increasing the amount of contingent reinforcement received.

5. *Small Group Research*

Exploratory studies in the training of interns are in process. A first study will examine the extent to which a type of social interaction training improves the conduct of effective group activity and heuristic teaching styles in classrooms. A second study will assess how an inquiry-oriented, as contrasted to a sensitivity-oriented, group process can be used to help interns to learn heuristic teaching styles.

6. *Heuristic Teaching and the Teacher's Sense of Personal Competence*

Beginning teachers' concern with their own personal adequacy and competence may reduce their effectiveness in the classroom. To be studied is the influence of feelings of personal inadequacy, conceptions of one's self, and actual classroom experience on the way intern teachers think about themselves in the teaching process. A basic assumption is that heuristic teaching, with its emphasis on inquiry and challenge, will be anxiety-provoking and thus aversive for many teachers and may also produce resistance and anxiety in students. The study will determine which types of teachers are more responsive to specific sequences of treatment techniques in reducing excessive anxiety. If feasible, the study will also investigate methods of modeling inquiry behavior for students. Part of the study will attempt to develop methods for training counselors to advise teachers faced with inquiry-oriented students. It is hoped that physiological telemetry can be added to the measurements in the study.

The Environment for Teaching

Teaching today is shaped by crisis and change—the crisis of a school experience that is dysfunctional for too many of the nation's children and youth, and change as a consequence of organizational and technological innovation. The environment we believe to be most necessary for effective teaching is one that we call the "open" school. We see the open school as displaying high organizational flexibility. Such a school is characterized by a differentiated staffing plan, flexible scheduling, collegial evaluation of faculty, provision for further career development, and arrangements for genuine collaboration with the community or neighborhood it serves. Much of the Center's research efforts in this problem area will concentrate on variables that affect these characteristics. The projects described below will be conducted by current members of the Center's staff and by new members from the Department of Sociology and the Graduate School of Business.

1. *Professional Socialization of the Teacher and His Career Development*

In 1967-68 this project focused on how the socialization effects of the first year of teaching affect the beginning teacher's sense of autonomy and his definition of the successful teacher. The project will now deal with the formal and informal process of "inducting" the beginning teacher and "resocializing" the experienced teacher who changes school systems. The project will seek to describe the process more adequately, to assess its impact on teacher behavior with more certainty, and to estimate the most probable outcomes, in terms of teacher behaviors, of specific ways of alleviating the beginner's initial fear of teaching and the experienced teacher's problems in his first year in a new school system. A part of the project is a study of the ways in which new teachers achieve autonomy within the school organization. We are particularly interested in the above processes as they affect open schools.

2. *Innovative Organization and Innovations in Teaching*

Whether, and how, educational innovation is introduced into a school is affected by the nature of that school's organization. To be conducted is a rigorous field study employing a highly structured and extensive interview technique to explore a wide range of propositions and theories about the process of organizational change in schools. These include the characteristics of the change agent, innovation as a decision process, the receptivity of a social environment to change, and financial resource allocation as an instrument of change. The information obtained will represent an important step toward a more comprehensive and accurate description of the innovation process. The ultimate goal of the project will be to generate a set of procedures or innovation plans that can be used as guidelines for introducing change in materials and creating open schools.

3. *The Teacher in the Authority Structure*

Six members of the Stanford Department of Sociology have formulated an extensive and integrated research program bringing certain sociological concepts to bear on the questions of educational organization and the school context of teaching. The theoretical basis for much of the investigation will be the concept of authority systems in formal organizations developed at Stanford. Authority systems are analyzed in terms of the process by which the performance of organizational participants is evaluated and organizational rewards and punishments are distributed. This concept has been successfully applied to five organizations in the United States and two in Nigeria. Within this frame of reference, the team will study patterns of evaluation and authority in schools, the role of the professional teacher in a bureaucratic organization (the school), and the status orientation of teachers as it relates to their professional behavior. Additional lines of inquiry will examine the social context of teacher-student relations, particularly with respect to students' educational and occupational aspirations.

Teaching the Disadvantaged

The disadvantaged student tends to reject the conventional educational system, first by failing to achieve its curricular objectives and ultimately by dropping out of it. His parents and community tend to regard the present system as merely another bureaucracy which they have little power to influence.

We believe that research and development on the education of the economically disadvantaged must *itself* become involved in the socio-psychological setting of the schools. Parents, community groups, and teachers must become participants in, rather than objects of, the design of education.

The teachers are the primary objects of our concern. The present-day teacher is often remote from the cultural life of the disadvantaged child, unable to influence decisions about the curriculum he attempts to translate to the child, and inadequately supported by training and resources to overcome the barriers separating the disadvantaged pupil from relevant educational experiences.

The Center's new program attempts to concentrate a portion of available resources on the problems of teaching the disadvantaged, making use of the experience and skills peculiar to this Center.

1. *A Community-Centered Teaching Laboratory*

The Center proposes to try out a means for entering an economically deprived community to conduct basic research and development on the teaching processes. The aims of the approach are to develop teaching programs that are meaningful to students, to engage parents and local community leaders in this process, and to develop ways of training and retraining teachers of the disadvantaged.

As an intervention strategy, the Center proposes to establish a Community-Centered Teaching Laboratory, located in the community to be served. The Teaching Laboratory can serve both as a laboratory and as a field station within the community. It would maintain close relations with the schools, but would also serve to link community life, concerns of parents, existing formal institutions and agencies, and teaching in the school. The Laboratory would serve for a period of two or three years, and might well then be phased out as an operating entity. The tested programs developed within the program could then be instituted in the schools of the community.

Arrangements for the Laboratory have been made with the elementary school system in an economically deprived community. The precise functions and strategies of the Laboratory will be developed as the community itself begins to define its own educational problems.

2. *A Diagnostic and Developmental Field Study*

Professionals attempting to introduce changes often fail to consider the feelings, thoughts, and attitudes of the participants in the teaching system. Efforts to involve the system's participants have in the past seemed time-consuming and unproductive. Yet it is impossible to ignore participant involvement in the education of the economically disadvantaged child.

A pertinent study in a high school system serving both high income and economically depressed areas will identify. four groups of informants, representing students, parents, teachers, and administrators. These informant groups, meeting separately in taped "brainstorming" sessions, will identify problems that they know about. A variety of techniques will be used to establish how each particular group sees the problem, and how they identify the forces contributing to the problem and ways of changing these forces.

At this point, four mixed groups made up of participants from each of the four original groups would begin planning for change. These groups would attempt to reach an agreement on problems posed and develop position papers to be sent to the total group. Finally, the recommendations of each group would be presented to the entire body of persons working on the problem.

3. *The Use of Small Groups to Improve Academic Competence and Self-Respect in Academically Disadvantaged Children*

To be conducted is a study aimed at helping "failures" and problem students become more effective by using the strong interpersonal forces that can be developed within carefully composed and directed small groups. Such students are assumed to have a variety of assessable aptitudes. Such assessment will serve as a basis for carefully composing small groups to serve as adaptive milieux. Students in these groups will be told that their primary function is to learn skills that will enable them to tutor younger children. Appropriate tasks, questions, and objectives will be established. The plan calls for minimal adult intervention. The work should yield a variety of training and retraining techniques for use by teachers.

4. *A Training Syllabus for Teachers of a Second Dialect*

A new project will undertake development of a syllabus for the teaching of standard English as a second language or dialect. It is assumed that the "first" dialect of the disadvantaged may be another English dialect or even another language, though not usually in its standard form. This project will apply the techniques of second-language teaching which are most appropriate for the special problems of teaching standard English to disadvantaged children.

5. *Procedures and Techniques for Restructuring School-Community-Teacher Relations in Impoverished Areas*

The project aims to improve teaching by using a team–including teachers, an experienced community action specialist, educational researchers, and representatives of the community–to develop and test handbooks, manuals, or other communications materials which will (a) train parents to support the education of their children; (b) show how policy-making school-community committees, parents' clubs, and mutual aid committees can deal with school problems; and (c) provide other aids for both the classroom teacher and participants from the community.

Center Service Operations

The following service functions at the Center are an integral part of its operation and contribute directly to its research.

1. *Microteaching Clinic*

The Center's Microteaching Clinic serves both as a medium of instruction and a vehicle for research. During the summer quarter, beginning teaching interns are trained in the microteaching procedures described earlier. After videotapes of their teaching performances have been analyzed, they are placed in the Intern Data Bank.

2. *Intern Data Bank*

The Intern Data Bank contains data on 170 intern teachers collected at the beginning of their training in June 1967, at the end of the summer period of that training, and again in May 1968 after they had had a year of teaching experience. Other data have been collected and stored on magnetic disks or in other forms. The Data Bank includes data on teaching behavior in 45-minute classes recorded on videotape; pupil achievement in response to that behavior; pupil reaction to the lesson; intern reaction to his own teaching of the lesson; pupil ability; intern ability; and intern attitudes, personality, and life history. These data are being used to assess the effects of training and experience on teaching performance.

3. *Research Methodology Unit*

The general purpose of the Research Methodology Unit is to ensure that the Center's projects use the best possible approaches to problems of design, sampling, measurement, statistical analysis, computation, data processing, and interpretation. Its services are available to all researchers at the Center.

4. *Publications, Dissemination, and Media Unit*

This new unit centralizes the Center's dissemination activities. It is responsible for the Center's publications and reports, editorial services, and library. It also coordinates the activities of the previous units on Film Production and Videotape Service.

Relations With Other Agencies

The Center maintains close relationships with the school districts which have served as sites for its work and with the Far West Regional Laboratory for Educational Research and Development. A productive relationship with San Jose State College is extending the Center's work in research and development on teacher education to the elementary level. The Center maintains close contact with the ERIC Clearinghouse on Educational Media and Technology at Stanford, and with other R&D Centers.

The Outlook

Much has been accomplished during the Center's life thus far; much remains to be done. Many of the problems inherent in organizing, staffing, and administering a complex research organization have been resolved. Specific contributions to our knowledge about, and methods of conducting research on, the teaching process have been developed and widely disseminated. The Center's problem focus has been redefined. We look forward to an intensified effort extending the research and development already initiated and creating new ideas in problem areas as yet unexplored.

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FILMS

Available for distribution:

1. Microteaching: What's That? 1967. Explains microteaching from the perspective of a teaching intern. 30 min., color. Price $200; rental $30.
2. Technical Skills of Teaching. 1968. A master teacher models three technical skills: silence (listening), reinforcement, probing. Commentary by F. J. McDonald. 30 min., color. Price $200; rental $30.
3. Teachers and Classes. Covers classroom discipline situations. 40 min., BW. (Address requests to Stanford University School of Education.)

In process:

1. Role-Playing. On role-playing as a teaching technique in a classroom situation. 20 min., BW.

For research only:

1. Intern Data Bank Storage Films. Thirty-two 40-min. BW films, each recording an intern's teaching behavior.
2. Intern Data Bank Time-Lapse Films. Thirty-two 40-min. BW films on interns' teaching behavior.
3. Math Presentation Mode Stimuli. Thirty-sic 5-min. BW films, showing 12 lessons presented in each of three ways.

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RESEARCH AND DEVELOPMENT CENTER FOR TEACHER EDUCATION

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The University of Texas at Austin

The Evolution of the Center

Although the Center was officially established in September, 1965, as a partnership of The University of Texas, the Texas Education Agency and the Austin School District, the kind of work it carries forward began ten years before in a program to experiment with ways of improving both the self-insight and the social insight of young teachers. This work was supported by the Hogg Foundation for Mental Health. In 1958, the NIMH supported this work on an expanded scale, with a grant for a five year demonstration program called Mental Health in Teacher Education.

Several theoretical propositions underlay this work. One was that openness to experience is a trainable characteristic. Drawing on experience with the assessment and training of business executives, the technique of assessment-feedback counseling was introduced. The results of individual personal assessment were used as the point of departure for self-exploratory sessions with student teachers. The assumption was that increased self-knowledge, acquired in a supportive, constructive atmosphere, would induce a persisting tendency to be more alert to one's own actions and their consequences. A corollary premise was that such self-knowledge would lead to firmer, realistic self-assurance and an augmented sense of self-worth.

Experience with this form of feedback demonstrated very quickly its additional value in establishing an emotionally significant, one-to-one relationship between the student and his counselor/instructor, in contrast to the relative anonymity maintained in the conventional program. In addition, it was striking how frequently students were unaware of the relevance of their personal, behavioral and motivational characteristics to the kind of teacher they would become. Increased awareness of the inevitability and legitimacy of such influences frequently drew the student into his own professional education in a much deeper, self-motivated way.

Further development of counseling procedures and revision of the curriculum to fit the developmental process which students were found to follow was increased by 1962, resulting in experimentation with 8mm. sound movies as a second kind of feedback data. Students were given the opportunity to see themselves teaching, and to discuss *why* they acted as they did considering both their own natures and the characteristics of the teaching situation.

The ultimate, practical point of these exploratory trials involved a second theoretical assumption: that openness to experience is a generalizing characteristic. Alert, healthily-toned acceptance of the facts of a teacher's own behavior, it was felt, would induce more alert recognition and more sympathetic understanding of his pupils' actions and feelings.

A third set of theoretical propositions was also at issue. It was assumed that the style of the feedback counseling would induce increasing autonomy in the student teacher: more willingness to assume responsibility and initiative, and growing skill and discriminatory judgment in making independent analyses and independent decisions. This was the best way, it seemed, to prepare teachers who would spontaneously encourage just such autonomy of feeling and judgment in their pupils.

It might be noted here that factorial analysis of a complex assessment program turned up, among other things, three dimensions which closely resemble those cited by Gage as primary components of the effective teacher:[1] (1) rational autonomy (his "organized, clear-thinking behavior"). (2) positive interpersonal attitudes ("warmth"), and (3) openness to pupil ideas and actions ("indirectness"). Thus, operational measures were created for each of the major propositions.

While the purpose of the experimental treatments was to increase the teaching effectiveness of students in these three respects, as well as in other ways, there is a very important, central difference between this personalized approach to the improvement of teaching and the approach known as micro-teaching which was being invented at about the same time at Stanford University. Micro-teaching, having identified a number of specific kinds of teaching behavior which are thought to be desirable, then coaches all students in a rather similar fashion to practice each of the desirable teaching tactics, one at a time. Thus, all students are uniformly encouraged to do less lecturing and ask more questions, as a way of permitting and encouraging intellectual initiative on the part of their pupils. The end result, it is hoped, is the development of a reasonably uniform style of teaching which all students will adopt.

In the personalized approach to teacher education developed at Texas, which might be termed "macro-teaching" for contrast, somewhat the same ultimate effects are sought but with a major difference in the method of approach, and with a somewhat different conception of the desired end state. Starting from the observable fact that each student has an idiosyncratic set of motives and his own style of coping with life, the ultimate goal of this training process is not to turn out teachers who are shaped into one "ideal" behavior pattern, but to help each student develop increasing effectiveness in using his own personal style. For example, a naturally reserved, quiet student would be shown how to evoke active responses from children in ways that are perhaps a little less reserved but nonetheless in keeping with his own behavior style. He would not be shown a dramatic showman of a teacher, and urged to emulate the ebullient, dramatic style of the "born actor."

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[1] Gage, N. L. Can Science Contribute to the Art of Teaching? *Phi Delta Kappan,* XLIX:7, March 1968, pp. 299-403.

The personalized approach simply recognizes that different teachers have very different ways of evoking child learning and it encourages each teacher to become increasingly skilled in his own particular way of doing it. Thus, a fourth proposition might be stated, that an idiosyncratic approach to the training of each teacher, tuned to his most pressing concerns and his individual behavior style, is an effective way to help him achieve autonomy, warmth and openness in his dealings with pupils.

There was a good deal of clinical and some experimental evidence to support these propositions; but much more rigorous experimental testing and better measuring procedures were needed. Consequently, in 1962 a controlled experiment was begun, under a U.S.O.E. grant entitled "Personality, Teacher Education and Teaching Behavior." The purpose was to test the effects of the feedback procedures on both the trainability and the transferability of openness in the pre-service teacher. Success depended crucially on the cooperation of the teacher education faculty and of the Principal and teachers of Highland Park Elementary School, and on the cooperation of many high school faculty members in the high schools of Austin.

The MHTE project resulted in the development of a diversified battery for assessing the personality characteristics of teachers, and increasingly objective measures of teaching behavior were devised. In 1962, at the same time as the new experimental study was begun, an NIMH grant was obtained for basic research on a new kind of measurement, "Computer Analysis of Personality." To insure synergy, all these operations were combined into a unit known thereafter as the Personality Research Center of The University of Texas.

Meanwhile, since the outset of the MHTE project in 1958, a large number of faculty members of the College of Education had been engaged in revising the curricular content of the pre-service education program. Often, this was done in team planning, by professors from two or three departments.

From the side of Educational Psychology, colleagues changed both the nature and the sequence of topics in the psychological area. From an almost exclusive emphasis in 1957 on test-theory and classical child development, by 1962 the content was changed to an interdisciplinary approach describable as "Behavioral Science Foundations of Education". This course content was both logically and operationally cross-linked with students' experiences in the curriculum courses in classroom participation and student teaching. Moreover, as was later measured systematically, there turned out to be an optimal sequence of topics which began with the students' own most urgent concerns. Only later did they transfer their attention, (and their new knowledge) to issues of child behaviors and the teaching of children.

Major revision and realignment of student learning experiences were initiated in Curriculum and Instruction. Increased emphasis was given to the idiosyncratic needs of the student and to the particular school situation in which he was placed.

As seems to have been true all over the country, when the entire body of beginning education students at The University of Texas was polled, as early as 1958, their most pressing recommendation was that they be given at least a taste of actual teaching responsibility at the earliest possible point in their training. The faculty involved in the exploratory study believed that this was a sound principle. There is nothing like actual involvement "on the firing line" to capture attention and secure strong ego involvement. Consequently, two alternate strategies were developed for supplying this kind of early experience. At the level of elementary education the program already took students into public classrooms in Austin as "observers." After careful planning with the faculty of the Highland Park School, in 1962, both control and experimental students were given actual teaching responsiblity early in their first education course, in the junior year. This progressed until, by the end of the semester, they were carrying as much teaching responsibility as many people in the conventional program were in their terminal semester of student teaching.

At the secondary school level, it was not possible to put hundreds of junior students into the same high school classes where other hundreds of senior students doing student teaching. Consequently, the first education course at the junior year was turned into a teaching laboratory. The students took turns teaching each other and acting as "pupils." This was an imperfect analogue of actual high school teaching, but it still constituted a genuine teaching experience. There was rich, fast feedback among the students as they took turns teaching one another. Eight millimeter movies were used here, for feedback counseling.

From the start of the MHTE project, another change was made in the way the college students were taught. It was certainly not a total change from earlier practice, but new, systematic emphasis was given to college teaching procedures which minimized lecturing and maximized independent study and student-initiated discussion of issues which immediately concerned them in their practical classroom experiences. For example, there was one device which worked very well as a first exercise for the students in learning to apply psychological and sociological principles to a case study of an individual. The attention of young coeds, especially, was almost magnetically captured when they were given, for their first case study, biographical and personal data on a young, unmarried, engineer who had just finished his college work and was applying for his first job. When asked to do a "blind" analysis, including a discussion of his potentiality as a husband and father, as well as his career potential, both male and female students put in several times the amount of work and thought which they ordinarily gave to an introductory case study of a school child. Thereafter, of course, their assignments did move to studies of child behavior, always with attention directed to such practical questions as, "What would you do about this particular characteristic if you were his teacher?" In short, the college instruction was planned so as to involve students in the very kinds of instructional experiences which they are enjoined to practice with children: relating subject matter and theory to issues which strongly concern the learner, providing for independent analysis of facts which are then checked against empirical evidence, and flexibly-led discussion of issues which have immediate curricular relevance and about which the students are also strongly concerned. Thus, the college instructors in this program were attempting, even more than usual, to provide living models of the kind of teaching which their students would hopefully do when they went into the school room.

The study which began in 1962 has just been completed. Considering the very limited amount of experimental intervention which was possible amounting, on the average, to about an hour and a half of assessment feedback counseling and a similar amount of video tape feedback counseling, the objective evidence for changes as a result of these experimental treatments is both positive and encouraging. As contrasted with a control group who otherwise received the same kind of instruction, from the same instructors, students who received the feedback in varying combinations showed positive change in openness to experience. The corollary premise was also confirmed that they increased in realistic self-confidence when faced with classroom problems. Secondly, their openness did transfer to their treatment of pupils. They showed a number of signs of more "indirect" teaching practices in video tapes taken at the end of their training. Thirdly, they showed more discriminating judgment and greater autonomy in conceptualizing and resolving school-related problems. Finally, their feelings toward other people, including children, showed increased warmth and positiveness.

Exactly how and why such changes occurred, and how they could be more effectively induced, is the subject for a considerable part of the research in the present R & D Center program.

As a result of such studies, the University of Texas Council on Teacher Education introduced two administrative innovations for all undergraduates pursuing a teaching certificate. For the first time, measures of motivational and personality characteristics were added to the assessment battery required of all teaching candidates. No student is ever excluded from training on the basis of this battery; but the College of Education now provides selective career counseling for students who display problems. Such counseling is offered to all other students, as well, and is now voluntarily sought by at least a third of all candidates.

When the new R & D Center for Teacher Education was founded in 1965, the work just described was one focal interest. Nonetheless, the mission of the new Center was much more broadly conceived. Whereas the earlier work emphasized mainly psychological aspects of teacher preparation, and primarily psychological techniques for inducing change, the national need clearly called for a great deal of attention to the specific, professional knowledge and teaching skills required to meet urgent social and educational demands. For example, the fostering of independent inquiry by children was receiving strong attention as a much-needed change from the passive memorization of facts and ideas. Perhaps the most successful move in this direction was the A.A.A.S.-sponsored development of entirely new curricula and teaching methods, known as "Science: A Process Approach." Consequently, as a natural counterpart to the counseling approach for increasing teacher autonomy, the University Science Education Center added its forces to the R & D program, with its in-service program for training elementary teachers in this new approach for which a Title III grant was secured for its non-research aspects.

Nationally speaking, we also needed to find better ways of educating teachers to individualize their instruction of children.

Therefore, the R & D Center took in a new project, "Individualized Instruction Through Team Teaching," inaugurated at Brentwood Elementary School, with the collaboration of a faculty member of the College of Education. This project planned to convert a conventional school into a partially ungraded school, with team-planning by teachers for the individualization of instruction. The R & D Center supplied two CAI terminals in the school. A member from the Math Education Center, and the College CAI Laboratory began to develop math programs for children on the computer, as a necessary first step to provide a place where *teachers* could learn how to use CAI facilities as part of their instructional program.

This same program for individualizing instruction was then instituted in another elementary school populated almost entirely by Latin-American children from Spanish-speaking families at the lower income levels.

In its first year the new Center took over one other program which was aimed at the unique need for teachers who could work effectively with Spanish-speaking children in the Southwest. This was the Bilingual Education Program accompanied by development of an in-service program of innovation and teacher education in the San Antonio schools.

Because the original plan of the R & D Center included all phases of dissemination as well as research and development, the gradual clarification of national policy into a separation of functions between the R & D Centers and the Regional Educational Laboratories made it essential to see that both functions were carried out, but under the new division of responsibilities which national policy dictated. The possibilities of developing a Regional Educational Laboratory in this part of the United States were explored resulting in the Southwest Educational Development Corporation coming into being within a matter of months as a cooperative endeavor covering the states of Louisiana and Texas.

During the second and third years, Center staff members were involved in two major undertakings. They were carrying out experimental studies which had been planned in the previous years; but they were simultaneously striving to coordinate both the conceptual design and the operation of all Center activities into a genuinely unified master plan.

The individual projects begun in the first two years were moving forward. For example, a new system for describing the *sequential* interactions of teacher and pupils in the classroom was evolved, along with additional new dimensions derived from empiricial analysis of classroom movies. This procedure was turned into a video tape coding system (FAIR: Fuller Analysis of Interacting Responses) which gave equal attention to child behavior and to teacher behavior, in order to permit the analysis of complete sequences of teacher-child interaction in the classroom learning process. A mechanized system was developed and put into operation for coding video tapes and feeding the results directly to computer tape. Rapid computer scoring permits fast feedback to the student teacher about his style of interaction with his pupils. This system also, of course, permits very powerful statistical analyses, of many kinds, to reveal general patterns of interaction that occur with different kinds of pupils or teachers; and it permits comparison of these objectified, quantified measures with many cognitive and emotional characteristics of both teachers and pupils. Such studies are now in progress.

A new experiment in live teaching

experience for junior secondary education students was undertaken. In this study, the prospective teachers have a chance to take responsibility for teaching children early in their training. Their exposure is short but genuine, and it is followed by video tape feedback counseling.

Work continued vigorously on the development and validation of improved assessment procedures, including two new systems for computer analysis of projective data. As an out-growth of an experiment in the second year, plans were laid for the experimental study of child learning gains as a criterion for measuring the effectivenss of personalized teacher education.

A science education program carried out two experimental programs for training undergraduates. It developed and tested several new instruments in an attempt to measure the kinds of gain in initiative and autonomous inquiry at which the teaching approach is aimed, but for which no one anywhere has developed adequate criterion measures. Ten studies were completed, such as one on the effects of the inquiry program on child gains in knowledge and aptitude test scores.

The team teaching program secured a Title III operational grant which was able to take over the equipping and maintaining of the media resource centers in the schools. Studies were completed of team planning phenomena. Other studies were completed on the effects of the over-all experience on children, as contrasted with children in comparable, traditionally organized schools.

The Bilingual program completed studies of the efforts of this program on child learning and prepared its final report.

A self-paced course in educational psychology was launched, with preliminary results indicating a number of desirable effects from this instructional process. A teaching laboratory for secondary students was put into operation, involving approximately 75% of all juniors in this part of the College of Education.

In still another project, a twelve-unit series of movie-based instructional units was developed, to show students the facts of life about working in a school as a formal and informal organization.

On the assessment front, some new concepts and new measuring instruments were adapted from the Cross National Study of Coping Styles and Achievement, which had been proceeding in the allied Personality Research Center from 1965 on. Pilot instruments were developed and tested, to measure both child and teacher styles of coping with problems of task achievement, authority relationships, interpersonal relationships, anxiety and aggression. Plans were formulated for using such instruments in future R & D work, as part of the assessment procedures for evaluating the effect of teacher-training on teacher behavior and on consequent child learning. This assessment approach leads to objective coding of the sequential behavior steps a person takes in reacting to a problem. The codes reproduce most of the idiosyncratic nature of each individual's behavior pattern; and they can be computer processed to perform many kinds of statistical analyses.

While these activities were going on, there was a major, continued press for the unification of the total program of the Center. By April, 1968, a unified conceptual scheme was spelled out which had been implicit in the activities of the Center, but which had not previously been stated in full, clear form. During this same period, the co-directors worked out a new plan of organization for the Center which would both accurately describe and effectively carry out the new program.

Thus, within a period of about two and a half years, this Center moved from a collection of projects which originated in two colleges and five disciplines (Educational Curriculum and Instruction, Educational Administration, Educational Psychology, Psychology and Anthropology) to a single, coordinated plan of operation. Needless to say, making the plan work in all its parts, and attaining truly successful articulation and integration of all its aspects remains a major undertaking for years to come. Nonetheless, to achieve this much accord on aims and operations among a multidisciplinary team, in a Center which is simultaneously embedded within a university and within a complex public school system, is something of an achievement in itself.

The Program of the Center

The program of the Center has two major aims:

1. Basic research on the effects of varied kinds of teacher education on actual teaching behavior; and research on the subsequent effect of such teaching behavior on relevant aspects of child learning.
2. The development of a teacher education system composed of a diversified array of many relatively small instructional modules. Put together in differing cominbations, such modules can be used in a flexible, often individualized manner for many kinds of teacher education. When any one module is ready for experimental testing, it can be tried out in many collaborating institutions, at both preservice and in-service levels.

Certain guidelines have been determined for this program, representing the fruits of previous research here and elsewhere. These are characteristics which are to be embodied in the total instructional system.

1. Teacher educators should, in a number of specific ways, instruct teachers in the same way that those teachers will eventually instruct their pupils. It has long been observed that people tend to teach in the way they have been taught. If a teacher is to follow the steps of instructional design which are illustrated below, in describing the content of an instructional module, then the teacher educator should do the same, thus giving the teacher firsthand experience in going through the entire process. Similarly, the teacher educator should use all of the instructional procedures which he wants the teacher to use.
2. There is some evidence from our earlier research that there tends to be a typical sequence of concerns in developing teachers, much like a developmental task sequence for growing children. It may be necessary to satisfy the early concerns before teachers can devote wholehearted attention to those aspects of teaching which come later in the sequence. Therefore, the teacher preparation program should take account of teachers' most urgent concerns and provide experiences which will aid in their resolution. Units of study thus should follow a psychologically relevant sequence, not necessarily a "logical" sequence, nor one which is uniform for all teachers.
3. Teachers in training should be involved early and often in taking active responsibility for the instruction of pupils. They need to do this in an actively involved way, not as passive observers or mere imitators of order-giving superiors. They need a chance to assess and learn from their own particular way of going at the job; they need personalized feedback,

that is, not just impersonal criticism, aimed at producing compliance with certain generalized rules of "good teaching." Certainly, a blind reliance or exposure to "practical experience" can lead to aimless activity or even to destructive effects. Simulated teaching situations may be more apt or more potent stimuli to learning than the "real thing," in some instances. There seems to be no fully adequate substitute, however, for an early experience of responsible involvement to make students alert and to make them actively *want* to learn teaching skills.

4. Teacher education must be made personally meaningful for the students involved. This may be one way to improve the currently wasteful ratio where two or three "teachers" are trained in teacher education institutions for every one who will eventually teach more than a year or two. From previous work at this Center, it appears that one way of making teacher education meaningful is through personalizing and individually tailoring the training program, rather than subjecting every incoming teacher trainee to the same basic curriculum and thereby failing to interest and retain many who might otherwise continue. In earlier research at this university, we found strong evidence for the proposition that only a humanized, personalized contact of student and instructor is likely to reach the majority of college students, so that they learn anything at all in a lasting manner. Their intrinsic need for a personalized relationship opens or closes their perceptual systems, and greatly facilitates or deadens their learning.[2]

5. The total program for any one student should be individualized so that he can proceed at his own best pace through the system of modules and, within certain limits, by a self-regulated choice of paths. This does not preclude grouping together students who have similar interests and similar learning needs; but it does put the emphasis on individual diagnosis of what each student needs.

6. Any innovations adopted in a teacher education program must include rigorous, planned testing of every procedure, with constant feedback and subsequent modification to insure the continual improvement of the program. For too long, the premises underlying much of teacher education have been unexamined, the results have been inadequate, and the occasional adoption of untested, unvalidated innovations has not begun to meet the needs of our society.

7. In assessing any teacher education program or module, the ultimate criterion is, "what teaching behaviors lead to pupil gain and how can these behaviors be produced?" Thus, the long range objectives of the teacher education program are pupil gain, achieved through the medium of teaching behaviors that result in the various forms of pupil gain for which the schools are responsible.

8. To the maximum degree possible, teachers in training should have an opportunity to use a diversified, multi-media library of resources. This includes books, of course, but also audio-visual materials in the form of videotapes, films, slides, etc. It also includes experience in the actual use of computer-assisted instruction for their own learning, and hopefully in the use of CAI methods with children.

9. Teachers need to be taught concept systems which will aid them in recog-

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[2] Peck, Robert F. Student mental health: the range of personality patterns in a college population. In *Personality Factors on the College Campus,* The Hogg Foundation for Mental Health, The University of Texas, 1962, 161-199.

nizing significant patterns in their own teaching behavior, in their response to children, and in the response characteristics of different children. Several systems of classroom interaction analysis are already available for this purpose and the Center provides coding services for use in student instruction.

10. Pre-service teachers need to be exposed to a variety of school situations. Often, it is not possible to do this by personal visits to many different schools. By the use of carefully selected or designed movie excerpts, however, it is possible to show student teachers vivid examples of pupils of different ages, ethnic backgrounds, socio-economic levels, and language groups. It is possible to illustrate some of the similarities and differences in the teaching of various kinds of subject matter. Some of the dramatic differences in teaching behavior between self-contained classrooms and ungraded, team-teaching schools can similarly be illustrated. Undoubtedly, effective use of such simulation materials will not merely consist of exposing students to them passively, but will include very carefully worked out and illustrated methods for involving students in lively, thoughtful discussion of the issues raised by such films.

11. The content of the professional education program must include information on behavioral science principles, and faculty consultation on their application to practical problems in the school setting. Much of this may be achieved through a degree of team teaching at the college level. For example, the discussion of movie excerpts described just above can be simultaneously led by representatives of curricular and behavioral science disciplines.

12. At least some of the instructional modules in the total system will be designed to cause the teacher in training to go through all of the steps of the instructional process. The teacher will systematically design and carry out a teaching process aimed at getting a particular kind of child to achieve certain specified objectives. Such modules show the teacher how various kinds of teaching strategies can be used, and how they can be tested and improved.

Contents of Each Module

In every module in the system, the teacher educator works out the following seven steps of the instructional process, so as to get the teacher to follow the *same* seven steps in designing the learning experience for a child. The construction of every instructional module includes these steps:

1. A statement of the premises, assumptions and rationale for the learning unit.

2. Specification of the behavioral objectives at which the module is aimed, usually in terms of teaching behavior. Such objectives range from the demonstration of a very specific skill in handling a particular process of mathematical instruction, for example, to the diversification of a teacher's repertoire of coping styles for dealing with varied problems, to the development of increased, realistic self-confidence in dealing with a given kind of child.

3. A complete package of the instructional materials to be used in this teacher education module: for example, a problem-posing film clip, a self-instructional computer program, a passage from a book, or other stimulus materials.

4. A very detailed explanation and illustration of how the instruction proceeds. This would be an instructor's guide, so to speak, for the teacher educator. It

would be designed to prevent, as far as humanly possible, a woodenly mechanical application which might pervert the very spirit and purpose of the program. For example, rather than rely solely on the imperfect communication of the written word, a film clip or video tape might show a teacher educator instructing teachers in the intended evocative, flexible, inquiry-inducing manner. This could be followed by a detailed explanation of ways in which the teacher educator could video tape or audio tape himself, and make specific comparions with the illustrative model, as a way of checking the accuracy with which he is carrying out the intended instructional procedure. The array of teaching procedures should include the following:

a. *Modeling procedures*--this includes effective lecturing, if it illustrates an expert-at-work; movies which illustrate an effective technique.

b. *Involvement procedures*--use of on-the-line teaching assignments to get the student deeply involved and concerned; active involvement of students in analytic discussions of a teaching issue posed by a five minute movie.

c. *Individualizing procedures*--programming course materials for self-paced study.

d. *Diagnostic procedures*--directing the instructor's attention to an individual student's point of forward progress, and providing a set of alternative procedures from which a next-step prescription can be drawn.

e. *Personalizing procedures*--study of the student as a person, using various assessment data, video tape performance data, and giving feedback counseling to the student. Both intellectual and emotional factors are considered. The student's unique life-plan is a central issue, including but not limited to career considerations.

5. A detailed description of operations which the teacher educator can perform in order to evaluate the effects of his instructional procedure. This includes both detailed assessment measures appropriate to the behavioral objectives of the module, and instructions for using, adapting or redesigning them.

6. When appropriate, procedures are designed and built into the module for assessing the effects on *children's* learning of teachers who have achieved the behavioral objectives of the teacher education module (or module sequence).

7. Suggestions and illustrations for redesigning the module for teacher education based on a cyclical use of feedback data from the evaluation procedures built into the module.

Different modular sequences will be developed in response to the need for specialized training for teachers in different subject matter concentrations, and for teachers who will work with specialized ages and populations of children. It is anticipated, however, that a great many module sequences will have value for all prospective teachers whose ultimate school assignment is virtually impossible to predict or control. It is also anticipated that a good many modules developed initially for pre-service teachers may have equal value for in-service programs.

In essence, this whole program looks toward the evolution of an ever-growing, diversified "library" of modules. In addition to the inherent flexibility of the modular approach, and the practical utility of having many self-contained instructional "packages" which teacher educators could use in many ways, this program also has the advantage of introducing a rigorously scientific model in the design and execution of every teacher preparation program. It also places the emphasis on what is learned by the teacher rather than on what the teacher educator does alone.

Moreover, it lays a foundation for measuring specific teacher competencies, in an objective manner. Ultimately, this might make it possible to replace teacher certification by course credits, degrees, and years with certification by measured competencies.

The initial target for the next two years of the Center's work is the evolution of a system of modules for the undergraduate preparation of elementary school teachers.

Several interdisciplinary task forces make up the Curriculum Building Program which is the central, unifying activity of the Center. Each task force includes representatives of the following groups: curriculum and instruction people, to plan training in teaching methods; educational psychologists, to plan training in understanding how and why children learn; public school principals, supervisors and teacher trainers; and three people to represent the three methodological skills of personalization, assessment, and learning technology. Eventually, it is hoped that instructors from Arts and Sciences disciplines can be added to these task forces.

The central program is served by four research and consulting groups (School Input, Personalization, Assessment, Learning Technology) and by three supporting services (Data Processing, Radio/TV, Dissemination). One major task of the Center's Executive Committee is to work out a set of principles, during the next six to twelve months, for deciding what mixture of modules will constitute a satisfactory program for one or another kind of pre-service teacher. This interdisciplinary, inter agency committee, meeting weekly, discusses the several kinds of content and methods suggested by the various task forces. The committee decides the appropriate proportions and timing of various kinds of content and instructional methods in order to make a coherent, integrated system out of the modules which the task forces are building. While it would be entirely possible to have task forces working in isolation from one another, such as one task force in science education and another preparing programs for social studies teaching, it is the consensus of the Center staff that it would be a mistake to have this proceed in mutual isolation, as has usually been the case in the past in teacher education. Certain modules will undoubtedly be developed which will be uniquely appropriate for elementary teachers who will specialize in one or another field of subject matter. Nonetheless, even students who spend their time in such training experiences need to have their total education influenced by the ideas of all groups represented in the task forces. It is a truism that learning any one kind of subject matter involves simultaneous, interacting effects of intellect, motivation and emotion. This is not only true of children, but of the teachers as well. Moreover, with a little appropriate compromise, it may well prove possible to design instructional modules which are appropriate for training teachers in a number of different subject fields. Indeed, one of the unresolved arguments in professional education, which is amenable to empirical testing, is the degree to which certain aspects of the teaching-learning process are generalized across subject matter and conversely, where important differences occur in the nature of the teaching-learning process from one subject to another. Experiments to test out alternate hypotheses can and will be worked out in the course of developing this instructional system.

Anticipated Products of the R & D Program

Research Output

A product of major importance will be basic research findings about the effects of teacher characteristics and of various teacher education procedures on actual teaching behavior. Of necessity, such findings must be validated in a final step where the teaching behaviors are compared against the effects in child learning: attitudinal and motivational, as well as intellectual learning. Through cooperation with the Computer-Assisted Instruction Laboratory, the basic research foundation for instructional design will be further developed. Methodological advances are also expected in the assessment aspects of the program where good progress has already been made in automating the assessment of personal characteristics so that large numbers of teachers and children can be studied in large scale, systematic research designs.

The Instructional Module Product

A diversified array of multi-media instructional modules will be produced for use in teacher education programs of many kinds. These will be ready for experimental testing and possible adoption in colleges and universities which educate teachers, and in programs of in-service education conducted by school systems and state agencies of education.

A total system of modules will be constructed so as to give balanced attention to all major aspects of teacher growth, to the degree possible in the time period available. In undergraduate training, the timetable might allow two full years of work. An in-service program of teacher education might allow only a few weeks in a year. Systems could be put together from the total "library" of modules for uniform application with all teachers-in-training; but they would not have to be used that way.

The modules could also be used in a much more individualized way. A teacher educator could guide different teachers to different combinations and sequences of learning modules to meet their individual needs. Ultimately, it appears possible to do much of this in a self-paced manner.

New Kinds of Teacher Educators

By active involvement in the research and teaching process, graduate students and post-graduate fellows will be produced who have been systematically trained in the pattern of the educational artist-scientist. Still other teacher educators will learn through participation in cooperative programs jointly carried out by the R & D Center, other colleges, and regional educational laboratories in several parts of the country. Several regional laboratories and numerous colleges which educate teachers have already made plans to collaborate with us. They identify kinds of training modules which are needed, they supply ideas for the design of such modules, and they collaborate in testing pilot forms of modules and module systems. Educators who have worked with these materials will not only be able to put tested instructional procedures into practice in their institutions; they will also be able to do a much more effective job of designing new instructional programs adapted to the needs of their own institutions.

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CENTER FOR RESEARCH AND DEVELOPMENT IN HIGHER EDUCATION

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CENTER FOR RESEARCH AND DEVELOPMENT IN HIGHER EDUCATION

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The Mandate

The mission of the Center for Research and Development in Higher Education is to assist individuals and organizations responsible for American higher education in improving the quality, efficiency, and availability of education beyond the high school.

The Center is the only research and development unit entirely focused on higher education. It must deal with the sheer magnitude of the American higher educational enterprise by designing research and development activities that span many features of the educational process and take account of the diversity of students and institutions that comprise the whole system of higher education. Thus, the Center faces the challenge of identifying achievable goals on the one hand and the danger of diffusion of energies and resources on the other. (Obviously, no agency could research *all* the problems of higher education.)

In fact, the components and processes of education are so interrelated that an organized examination of any given problem necessarily involves consideration of a number of related questions. The question of student accommodation in an institution or system, for example, involves consideration of student characteristics and goals as well as faculty, curriculum, institutional goals and values, and planning.

To facilitate program development, the Center has clustered its research probes around two major concerns of American higher education–the impact of college on student development, and organization and planning in higher education. In each program, related projects attack particular facets of these overall concerns in a systematic effort to develop information which will broaden perspectives of practitioners and expand the range of fruitful alternatives in practice. In the course of research, staff members attempt to identify additional problems and issues which may serve as springboards for further research.

Indeed, the rapidly changing ecology of American higher education has continually added new dimensions to the Center's role and responsibility and served to shape and sharpen the lines of inquiry already underway. Developments since 1965 have also underscored the urgency of the need for research in higher education. Some of the developments bearing on the problems and direction of higher education are: increased societal concern for post high school education; impetus from many sources for the establishment of universal education; the growing involvement of higher education in seeking solutions to social problems; massive financial assistance to colleges and universities from the federal government; the growing desire among students for participation in the educational process; and the changing world of work.

Also, as institutions and organizational patterns become more diverse and complex, many questions involving value judgments are being raised--questions concerning the appropriate nature of complex universities, the relationship between institutional characteristics and quality education, the dominant values of college education, how best to accommodate students of varying characteristics including those with differing cultural backgrounds, and how to assign priorities in the overall economics of higher education. Educators, faculty, and students continue to ask whether universities can grow indefinitely in size, whether they are organized in the most effective way, whether there should be greater participation in decision making by all components of the academic community, and whether curricula and teaching methods can be reformed and new models established.

The Means

In research, Center staff members use the tools and techniques of the behavioral sciences to gain new information about the educational process. Through a program of development, the Center relates these findings to present and future problems of higher education and, wherever possible, devises theories and models to test the findings in an institutional setting. The Center's dissemination program makes available usable research findings. A program of training for future researchers and practitioners offers the next generation of scholars experience in conducting research and educators a chance to enter their professions informed by the latest research.

Research Programs

The Center's aim to improve the practice of higher education dictates a problem-oriented research program. Research staff members from sociology, psychology, education, anthropology, statistics, economics, and political science as well as education bring to bear expertise on the various facets of research on education while focusing on their relevance to problems in educational practice. This interdisciplinary staff assays the interaction among the three crucial components of higher education--students, teachers, and administration--against a background of diverse institutional goals and structures. A number of these studies, largely longitudinal, are complementary. Using common assessment instruments, related institutional settings, and shared theoretical bases, the studies are designed to be mutually reinforcing.

Research Program I--Students and the Impact of College

As a primary product of and *raison d'etre* for the American system of higher education, the student is a logical focus for one of the Center's major research and development programs. The significance of student-related questions has been sharply accentuated in recent years with the growth of student concerns about the college experience.

The major objectives of this program are: first, to develop an adequate body of knowledge about the psychological, intellectual, and social changes that take place in college age youth; second, to determine how salient elements of college environments relate to different types of change in different students; and third, to contribute to the formulation of a theory or theories of postadolescent psychological and educational development.

The complexity and diversity of the American educational enterprise prescribe a wide-ranging, coordinated examination of the psychological, intellectual, and social development of youth from their precollege days to alumni status. We need to know what happens to students as they leave their home environments and enter junior colleges, four-year colleges, universities, and graduate and professional schools. We need to know who goes to college, how and why students choose an institution, and how and why different institutions have different effects on different students. Maintaining close communication with educators in the field, a core of studies is designed to assess the impact of living arrangements, peer associations and the dynamics of student subcultures, personality factors, family background, and institutional goals on student development over the college years. Characteristics of faculty members and their impact on students and on the organization of knowledge and methodology of teaching are receiving scrutiny in another major phase of Center research.

Precollege Experience. One large-scale project, based on a precollege sample, is a six-year study of nearly 100,000 high school students in four states to examine the decision-making process regarding post high school education and careers, and to determine the relative influence of parents, schools, and peers on those decisions. The initial phase of a related project concerned the relationship between the rate of college attendance and the type of higher education institution available in the community, and included a study of the relationship between college attendance and performance and a number of variables, such as ability, socioeconomic background, high school achievement, vocational interests, and personality characteristics. The second phase of the study followed high school graduates for four years after high school through patterns of work, college, and marriage and focused on the impact of college versus employment on change of values and attitudes. The third phase of the study, based on the same sample, examines closely the factors associated with various patterns of college attendance.

Development during College Years. The interaction of various types of students with on-campus and off-campus subcultures is the subject of a study based on the premise that peer groups, along with individual psychological propensities, are major influences on student life and development. A second study of student development assesses the implications of the differential education offered diverse students in 10 colleges committed to experimental and innovative programs. The possible influence of campus residence and associated peer groups on student change in measured personality characteristics is the focus of a student development study underway on one university campus. The major variable, personality change, will also be examined in relation to membership in special subcultures, academic majors chosen, and student perceptions of the campus.

The statement by one academic senate that "the incentive to improve teaching waits on recognition....Recognition waits on acceptable methods of evaluation..." was the impetus for a pilot project studying characteristics of faculty members and their impact on students and the organization of knowledge and teaching methodology. A further series of studies will make use of data and instruments developed in the pilot project to study the characteristics, concern, life patterns, and sources of satisfaction of faculty in 20 institutions being studied in three other Center projects (student development, interaction in student subcultures, and implications of differential education). This will make it possible to relate the longitudinal changes in students to information about faculty in the same institutions.

Postcollege Years. Although a great deal of research energy now is being focused on the development of basic knowledge about undergraduate education, little is known about the relationship of a college education (or type of college education) to students' personal and vocational development after graduation.

One two-year study now underway is addressed to the question: Are our colleges confining themselves to the function of producing scientists, teachers, technicians, and businessmen, or are they also fulfilling the objective of producing autonomous, reflective, creative, and mature individuals?

Several studies, discussed as part of the Center's research on organization and planning, also will provide information relevant to the postgraduate years. For example, one three-phase study of graduate education includes an assessment of student and faculty attitudes as differential characteristics that contribute to the character and quality of graduate programs. Another project, concerned with new directions in education among professional schools, examines principles and practices of teaching and learning and innovations that relate to them. In another project, professional education is being studied to reveal the role of colleges and universities, including professional schools, in the preparation of leaders in government at local, state, and national levels.

Research Program II--Viability of Institutional Structures and Functions for the Future of Higher Education

One of the most complex and urgent issues in higher education today is whether existing institutional structures and functions can meet future educational needs. The issue is complex because it has so many dimensions. How do we cope with increasing numbers of students and assure that all have an equal opportunity for education, and what is the significance of numerical growth and program diversification for the economics of higher education.? No less important are questions and problems dealing with the relationship between the modern university and society, the authority structure of the institution itself, and matters such as student participation in governance.

The issue is urgent now because the importance of educational institutions in training the expert society and liberating the intellect to respond to a world culture is matched by student disquietude and social malaise. Questions are being raised not only about the efficiency and flexibility of institutional arrangements but also about their very rationale, authority, and necessity. The institution of higher education, *qua* institution, is required to show the viability of its organization and planning for future needs.

The long-range objectives of this research program are: first, to determine the external and internal factors affecting present institutional structures and functions; second, to test these findings against data from the program of research on student characteristics and the dynamics of learning environments; and, third, to use the results of these analyses of human and organizational interaction as the basis for building models of educational structures and functions that can be utilized in developmental projects in the field.

Governance. The questions of who governs institutions of higher education, how, and with what effect have been raised by campus constituencies which challenge the established patterns of organization and administration. How faculty participate in governance at the University of California is the subject of a pilot study focusing particularly on the organization of the Berkeley Division of the Academic Senate and its most powerful committees and characteristics of committee members. The investigation is directed toward developing a theoretical context within which problems and processes of faculty governance can be understood.

A study of administrative orientations in the large university approaches governance from another avenue. The project is based on the assumption that large universities are governed by little-understood processes and that a major trend is the development of large, distinct, and important groups of administrators. The study will focus on the social characteristics, distinctive viewpoints, and organizational role of these administrative officers in an attempt to contribute to an understanding of modern university governance.

The purpose of still another project is to study the way in which differing educational objectives in two Western technological societies--the United States and Sweden--are translated into the structuring and administration of higher education. This comparative study of aims and administration in higher education is based on three hypotheses: that educational aims vary even between technologically advanced societies, that these aims are reflected in and implemented by the structuring and administration of educational institutions, and that the structuring, therefore, covaries with the educational goals.

Coordination. Coordination is a twentieth century organizational form which is becoming widely applied to mechanisms for decision making. Formal coordinating agencies in state systems of higher education are relatively new, and the experiences of one state are of interest to others.

The less obvious and possibly unintended effects of statewide planning and coordination in higher education are the subject of a four-state study. The project examines the effects of statewide planning to see whether shifts in kinds of decisions made at the local or institutional level result in qualitative changes in the character and functions of the institution and to assess whether statewide planning and coordination foster diversity or conformity in education.

The California and Wisconsin coordinating agencies for higher education have undergone changes in structure and procedure in response to the environment of conflict in which these coordinating bodies must make their decisions. Case studies of California and Wisconsin experiences have identified these changes, probed their causes, and assessed their effects on the coordinating process.

Innovation. How--and to what extent it is possible--to rock the boat in educational institutions and systems is the focus of inquiry for a cluster of projects dealing with innovation in education. What makes an innovation acceptable--congruence in administrative patterns, goals, personnel? What makes it effective? And what effect does the innovation have on the organization, goals, and people of the system or campus to which it is introduced?

The focus of one project, curriculum building for undergraduate colleges, is on models of instructional programs. The study is concerned with the application of the "system" approach to model building and the relationship between innovation (a new model) and the current standard model, between the instructional program of a new college and the larger system of which it is a part. A study of institutional character is exploring the assumptions, objectives, and values that underlie and give direction to institutions which have developed distinctive patterns in their educational processes. The researchers expect to determine how institutional purposes are variously expressed and modified by the principals in the learning relationship, the students, faculty, and administrators.

Graduate and Professional Education. The contemporary truism of rapid technological and social change probably has more immediate impact on the organization and emphases of graduate and professional education, which is closely geared to society's demands for professional manpower, than on undergraduate education. Thus, within the parameters of the disciplines of graduate education there lies a fruitful area for study of innovation in organization and administration. The initial phase of one Center project identified issues and problems in graduate and professional education, explored the literature, and produced an annotated bibliography. In the second phase, researchers will identify the ways in which outstanding graduate institutions are organized and administered for continual review of their doctoral programs. In the final phase, innovations in graduate education will be reviewed in three institutions that have introduced fundamental changes in the organization of graduate education. Another study explores new directions in education among professional schools and has as an immediate goal the development of a series of descriptive and analytical studies of innovations in organization, curriculum, and teaching in several professions. These studies are to form the basis for a future research program in six professional areas: law, medicine, engineering, architecture, agriculture, and business administration.

Development and Dissemination

The Center's development and dissemination program is based on the assumption that research must be both interpreted and widely communicated if it is to have an impact on practice. Opportunities for making findings meaningful to educators are intrinsic in the Center's problem-oriented approach to research. Some developmental activities grow directly from individual research projects and are carried out and administered as part of the project. Project staff members often provide preliminary feedback reports, or consult with and interpret findings to individual colleges to help institutions plan programs to implement findings or continue self-study. Development staff members advise and consult with project staff and are usually involved in preparing feedback reports. They also assume primary responsibility for planning and directing the activities conferences, workshops) and publications designed to disseminate generalized findings from individual programs and projects to the higher education community.

Conferences sometimes take the form of workshops in which educators, under the guidance of Center research staff, work with data in an effort to understand their implications for practice and improvements. Some conferences focus on keeping educators current on new knowledge and new practices in higher education or discussing the implications of data with the colleges participating in Center research. For instance, the Center's jointly sponsored conferences with the National Association of Student Personnel Administrators and other professional associations bring high-level practitioners together with research findings from an array of projects, offering a chance to share experiences with other practitioners and open a dialogue with researchers.

The results of research and subsequent developmental activities are made known to the broader educational community through interim reports, monographs, and reprints. The dissemination-development section publishes research volumes of findings from major Center projects.

Timely feedback on implications of research is possible on long-range studies through the Center's quarterly *Research Reporter*, distributed to more than 5,000 practitioners in education. This publication synthesizes Center research, outlines implications for practice, and announces other Center publications. This mass distribution helps generate new applications of research findings and, through reader response, new developmental activity by the Center.

The Center reprint series makes available to a wider audience published articles by Center authors. In addition to materials published under Center auspices, scholarly and commercial presses and professional journals publish books and articles based on Center research. As with other research and development centers, all findings published by the Center are made accessible to the national education community through reproduction and dissemination from Educational Research Information Clearinghouse (ERIC).

Built into the Center's research on the 12 member colleges of the Union for Research and Experimentation in Higher Education (UREHE) and the 16 institutions in the Institutional Character study are extensive provisions for feedback of the findings. Also, relationships have been developed with these colleges in which some may serve not only as sources of research information but also as demonstration centers for developmental models.

Training for Research and Practice

As a major research and development unit, the Center assumes the responsibility for providing training in research methods for the next generation of scholars and educators. As apprentices and research assistants, many graduate students in the social and behavioral sciences and future educators work on projects close to their areas of inquiry, combining field practice, theory, and early review of findings from pertinent Center projects.

In the fall of 1966, the Center became a participating institution in the Latin American Internship Program which brings young university administrators from public and private institutions of higher education in Central and Latin America to this country for advanced study in the field of higher education. The program includes study at the Center and an internship in a California or out-of-state institution.

Since 1961, under Ford Foundation funding, the Center has provided training, supervisiors, and technical assistance for the developing system of two-year university centers in the proveniences of Chile, under the University of Chile Regional College Program. The project's aim is to decentralize, and thus democratize, higher education in Chile. The Center has been instrumental in the development of these regional university centers in Chile. The project includes an inservice program for teachers in Chile and periods of graduate study in this country for selected teachers and administrators.

Accomplishments

The Center's aim--to conduct and publish research with relevance to educational practice--requires that the audience with the capacity to effect change be reached. To this end, Center staff members work with decision makers in education to put into practical application theories evolved from Center research findings.

Reaching the Educational Community

Many Center studies are longitudinal and thus are still underway. The following 13 projects have been completed, and reports on them have been published or are in press.

Two studies completed in 1966 were Organizational Changes in Coordination, a case study of the California Coordinating Council for Higher Education, and a study of State Level Governance of Junior Colleges, related to proposed organization in California. The final report of another study, Problems and Issues in Accreditation by Specialized Agencies in Post-secondary Vocational-Technical Curricula, is in press. Final reports have been published for two phases of the three-phase Study of High School Graduates and the report on the final phase is in press. Final reports also are in press for Junior College into Four-Year College: Rationale and Result in Two Institutions, Conflict and Coordination in Higher Education (the Wisconsin Coordinating Council experience), Innovations in College Teaching, Education for Professionals in Public Service, and Institutional Accommodation of Students Typed by Ability and Intellectual Motivation. Completed in 1968 were: Pilot Study of Faculty Activity Patterns in Relation to Student Values and Perceptions, Education of Men of Science (Harvey Mudd College), Inventory of Current Research on Higher Education (cooperative project with the Carnegie Commission on the Future of Higher Education), and a study of Institutional Character.

These reports, as well as preliminary findings, are announced and synthesized in the *Research Reporter*. This publication is a continuing link with college and university presidents, administrators, and faculty members across the country. The *Reporter* has proved itself an effective agent for reaching the educational community, eliciting responses from more than 2,100 educators since January 1967. Correspondence has come from college presidents, deans, professional organizations, foundations, and state and national government agencies, covering 47 states and 14 foreign countries. Editors of several professional journals have requested permission to reprint *Reporter* articles, thus broadening the dissemination of Center research in scholarly and professional circles.

Speeches constitute an important aspect of the dissemination and development program, since topics are usually assigned in terms of an educational problem to which the speaker brings all of his research background. During the current year, the Center was represented at almost all of the major conventions concerned with higher education. The Center also uses conference workshops and consulting activities to bring educators face to face with research findings and researchers in an attempt to develop implications and stimulate concrete proposals for practice. Related to implementation of research findings, these conferences included participation of Center staff with development consultants, College Board regional executives, university presidents and faculty, administrators, deans, leaders in state and national councils, student personnel administrators, and scholars in fields of special interest. Conferences have been cosponsored by the Center and the Union for Research and Experimentation in Higher Education comprised of 10 experimental colleges in the East and Midwest, the National Association for Student Personnel Administrators, Western Interstate Commission on Higher Education, and University of California Extension.

Evidence of Impact

To discern the impact of research on the educational community, the Center staff looks for evidence of change in educational practice. Several completed projects have resulted in highly visible changes in institutions or systems of institutions under study, and subjects of study in several other projects in final stages have shown receptiveness to change.

An imaginative series of liberal arts colloquia, an experimental program of educational retreats at Eastern Montana College, is the result of a workshop consultation visit to the Center in winter 1967. The college president and several members of the faculty senate met with Center staff members to discuss ways to vitalize the liberal arts and sciences at the college. After the Center visit, Eastern Montana secured a grant from the Danforth Foundation to fund the series of biweekly, two-day retreats held off campus. Each session (for which students receive one unit of credit) will focus on some basic and significant concept from the broad areas of humanities, social sciences, or physical sciences. The purpose is to improve teaching and integration in the liberal arts by involving students and faculty in a dynamic and interactive educational experience. Continuous evaluation of the program will be carried on through questionnaire and attitude tests administered to the participants.

Early Center findings made available to Harvey Mudd College administrators and faculty have led to changed policies in grading and student evaluation. The research, begun as a four-year study in fall of 1965, focuses on student development over the college years. Continuing data feedback also provided a point of departure for a three-day conference of institutional self-scrutiny to evaluate the goals, curriculum, and environment of the science and engineering institution after its first 10 years of operation.

Randolph Macon Women's College has

accepted recommendations for change in the college's curricular requirements contained in an evaluative report by Center researchers. The study team submitted a 20-page report in March 1967, and, following a month of discussion, the principal recommendations of the report were adopted. They will go into effect for the class entering in fall 1968 and will be optional for the graduating classes of 1968, 1969, and 1970. The administration and faculty agreed to revise the academic requirements to be less specific and more flexible. Students will be given a broader range of choices in meeting graduation requirements in mathematics and the natural sciences, history and social sciences, and philosophy and religion. The foreign language requirement now can be satisfied with either one language or two. Literature and fine arts courses have been added to the requirements. The faculty also approved recommendations for general curricular changes which would increase the opportunities for colloquium courses and independent study, visiting lecturers and artists, and exploration of possibilities for interdepartmental courses such as those now being offered in Asian studies.

Recommendations calling for a separate state board for junior college governance contained in a Center study have been incorporated in a bill (S.B. 669) successfully passed by both houses of the California State Legislature in 1967. The study of the feasibility of a separate junior college board was commissioned by the California Coordinating Council for Higher Education. Following submission of the report, the study participants worked with various state groups in interpreting the report. The question of a separate board was raised in earlier sessions of the legislature, but was not acted upon until 1967.

Public higher education in the nation's Capital is a reality since the signing of the District of Columbia Public Higher Education Act in 1966. T. R. McConnell of the Center was one of eight members of a committee appointed by President Kennedy to study higher education in the District and make recommendations. The committee's report noted that "Washington is without a single publicly supported institution at any level beyond high school..." to help the one in every six in this city who "live in poverty and who generally suffer the attendant evils of cultural deprivation and the stifling environment of the slums...."

The committee recommended the immediate creation of a publicly supported community (or junior) college for vocational, technical, and general education; a college of liberal arts; a liberal scholarship program to help District students pursue (after two years' work in the community college) special courses not offered by the proposed public college of liberal arts and sciences; and a center for high level and postdoctoral studies. The results are legislation establishing Federal City College, a public liberal arts and sciences college with both two-year and four-year programs, and the Washington Technical Institute which will offer vocational-technical education to "fit the individual for recognized occupations" as well as noncredit courses for upgrading technical skills.

In the Center's design of research on the 12 member colleges of the Union for Research and Experimentation in Higher Education (UREHE) and the 16 institutions in the Institutional Character study are extensive provisions for feedback of the results and future cooperation in implementing and field testing recommendations. Members of the UREHE Board scheduled a meeting to share and evaluate findings on their schools and the Board stated that the preliminary reports had generated considerable faculty discussions on their campuses. Institutional Character study staff conducted consultations with staffs of individual institutions following delivery of the reports. The effectiveness of Is based on these results will be evaluated in a special study.

Refinement and Utilization of Research Resources

Accumulated data from the Center's 12 years of research activity (first as the Center for the Study of Higher Education and since 1965 as a national center) are being codified and stored in a Data Bank for use in secondary analyses and possible longitudinal followup on the research subjects. In this bank are socio-psychological and/or economic status data on more than 200,000 subjects. Several of the Center projects are now drawing on the Data Bank. Program coordinators are currently developing proposals for some project work based primarily on material in the Data Bank rather than on new surveying work.

The Carnegie Commission on the Future of Higher Education, directed by Clark Kerr and Center researchers, felt the need for information about research in progress in higher education to avoid duplication of effort and establish a basis for complementary or collaborative research. In the fall of 1967, under funding from the Carnegie Commission, the Center undertook to inventory such research, primarily in the United States, but to some extent in other countries.

The project indentified more than 1,600 individuals known to be or considered likely to be engaged in or knowledgeable about important studies in the field of higher education. These researchers were sent questionnaires on the research underway and the nature of the anticipated findings. Meanwhile, a classification system was developed to categorize the type of research projects as the information was received. To date, the project has accounted for some 700 current or unpublished research projects. This project has developed the only known summary of currently ongoing research in higher education--research that has as yet not been officially reported or published.

The Future

A projection of the Center's future direction and success can be discussed on two general levels. On the first level are those measurable, more or less quantifiable accomplishments that can be predicted on the basis of current plans and programs. The following outcomes are anticipated within the next six years as the result of Center activity:

1) The Center will have accumulated, synthesized, and disseminated widely a body of related knowledge about higher education covering the following areas: the impact of college on student development; the function and structure of higher education; the economics of higher education; the analysis of different types of institutions (for example, the junior college); and the accommodation of students in a "system of diversity."

2) A number of demonstration centers, models, and similar devices for illustrating innovations will be developed, tested, and made available or known to personnel in higher education.

3) Research efforts will culminate in the formulation of or contribution to a body of theory related to various aspects of higher education, such as a theory of student development.

4) Several hundred colleges and high schools which have cooperated with the Center in its research will have received feedback concerning various aspects of their institutions, outlining implications for change and innovation.

5) Many hundreds of teachers, administrators, and members of governing boards will have participated in workshops, conferences, and seminars on how to improve the structure, programs, or process of higher education.

6) Countless individuals in higher education will have received information concerning Center research findings through: Center staff participation in programs of professional associations at state, regional, and national levels; publications of Center staff in professional journals, and publications of papers, monographs, and books by scholarly and commercial publishers and by the Center; and wide distribution of such general publications as the Center's *Research Reporter*.

7) A number of instruments to assess students and institutions, and thus to assist in the educational and evaluation process, will have been developed, standardized, and prepared for distribution and use. Examples of instruments under development, or currently being standardized and refined are: Omnibus Personality Inventory (measuring personality orientations of college students), Descriptive Assessment of Learning Environment (assessing environmental categories as seen by faculty, students, and administrators), Discussionaire (facilitating assessment of the nature and quantity of student interaction outside the classroom), and the Faculty Questionnaire (assessing several relevant dimensions of performance of faculty and of their work-related characteristics).

8) Many institutions will have been assisted in implementing useful programs of institutional research.

9) Several hundred graduate students studying at Berkeley will have received training in research through association with the Center.

10) Because of its authority as the pioneer research agency in higher education and its wide contact with decision makers in colleges and universities throughout the United States, the Center will have generated a significant impetus for improving educational practice through research.

On the second level, anticipated future Center contributions cannot be as clearly identified and can be stated only in general terms.

All indicators point to a steeply accelerating rate of change in American society, and the consequences of this phenomenon for education need no elaboration here. Project any current trend--birthrate, cybernetics, student activism–a short way into the future (1984?), and the repercussions for education are clear and compelling. To maintain relevance of the Center's research program to the rapidly changing challenges to higher education, a study team of senior researchers in the Center will survey the national field of higher education and recommend the problem areas of greatest import and need which should be the basis for organizing a new research and development project in the following year.

One emerging problem area is the challenge to implement the concept of universal higher education. How are students as individuals, particularly those of low ability, low motivation, and of various cultural backgrounds, to be accommodated? We probably know a great deal about how "average" or highly selected students learn and develop, but we must learn more about the problems and poten-

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tial of minority students and those students who drop out of school.

Another question the Center must address is: what is the role of higher education in the urban community? The trend toward urbanization generates attendant problems which seem to become more serious each year. The university has a reservoir of human talent committed to discovery of knowledge within a discipline of objectivity. American society increasingly turns to the university for aid in developing viable options for a complex society. How should colleges and universities assist in urban problems? Should they serve primarily as research or service agencies on problems or should they assume the role of social engineers in effecting change? Should they effect full partnership with urban government in the task of renewing social and cultural structures?

Still another question on the horizon is: what is the role of higher education in continuing education? Is there sufficient interest on the part of faculty and administration to make any substantial progress in providing continuing educational opportunities for out-of-school youths and adults?

To enable educators to adapt constructively to the radically altered societal circumstances in which they will have to function in the future, at least two things will be necessary: first, a coherent theoretical and factual base for understanding the components, processes, structure, and ultimate purpose of higher education; second, informed guidelines and means for shedding outmoded educational practices and for continuous self-appraisal, renewal, and innovation to meet emerging needs.

The Center is well on its way toward production of a significant body of knowledge about higher education. The momentum of its research program and the cumulative process will generate the critical mass of information that can provide a framework for understanding and improving the education process. The Center's research interests focus on the dynamics as well as the substance of innovation. Several new Center projects will attempt to illustrate to the higher education community how new policies and innovative practices based on research findings can be effected. Another project will establish a working relationship with certain institutions of higher education so that findings can be tested in actual field situations through specific developmental programs. A model for institutional planning will be designed which might serve as a guideline or pattern for the organization institutional planning programs. Case studies of organization of institutional planning as they relate to the model will be published. An informational training program will be carried out for persons responsible for institutional and statewide higher education planning.

The Center's data resources, its research interests, and its wide contacts in the educational community place the Center in an effective position to help those responsible for higher education to deal successfully with the issues, demands, and changes facing higher education in the future.

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CENTER FOR STUDY OF EVALUATION OF INSTRUCTION PROGRAMS

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CENTER FOR STUDY OF EVALUATION OF INSTRUCTION PROGRAMS

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Purpose

The Center for the Study of Evaluation of Instructional Programs officially began in June, 1966 under USOE sponsorship. Its two years of operation have been devoted to analysis of the Center's three basic purposes: (a) to develop and field test systems for evaluating instructional programs; (b) to identify, measure, and study variables relevant to the evaluation of instructional programs; and (c) to clarify the process of evaluating instructional programs by formulating appropriate theory.

Rationale

In the foregoing statement the term "instructional programs" includes classroom procedures, programs and procedures of individual schools and school systems, as well as institutions of higher learning. Special attention must be given to the multiple consequences produced by the interaction of instructional programs with students in different contexts.

The field of evaluation is so broad and its uses are so varied that some delimitation of effort is necessary. Although there are common elements in all educational evaluation systems, there are also differences. These differences stem from the uses to be made of the evaluation report.

Evaluation of students for educational guidance or for the selection of appropriate educational treatments requires for each child complete information related to the available educational options. In this case, the available options determine the type of information needed. On the other hand the national assessment program does not require complete information on each child. Item sampling is possible, and test items must have social validity.

Evaluation techniques used for the accreditation of schools and colleges quite properly stress available resources as well as the accomplishments of graduates. The purpose of the evaluation is to predict the effectiveness of the school program for a five- or ten-year period and to suggest program changes.

Evaluation of instructional equipment and materials is intended to aid schools in their selection. In this case, an effort often is made to evaluate the materials while holding the teacher variable constant. Conversely, evaluation of the effectiveness of individual teachers requires information concerning the difficulty of the teaching assignment along with indicators of the teacher's effectiveness.

Focus

Though evaluations for the aforementioned purposes are important, they do not represent the central thrust of the Center. Instead, the Center emphasizes the development of information systems for the continuous evaluation of ongoing school programs. The impetus of basic research stems from the requirements of developing the systems. The goal is to design different systems to inform (a) the classroom teacher, (b) the school principal, (c) the board of education, and (d) planners of higher education programs.

Inherent in this emphasis is that although each user has some unique needs, there are also many common elements. Therefore, a part of the work of the Center is organized around variables common to all evaluation systems. These variables are categorized as instructional, contextual, and criterion variables.

In their evaluation efforts, the four "users" mentioned would want to know: What socioeconomic influences are operating in the community, the school, and the classroom (contextual variables)? How can we measure student performance to determine whether the teaching objectives desired by the teacher, the school administrators, and the community are being met (criterion variables)? What kinds and sequencing of educational treatment and curriculum materials--also considering interaction of treatment and materials--best facilitate the student's ability to learn (instructional variables)? Indeed, what is involved in the student's learning processes, such as memory storage, information retrieval, cognitive strategies, and transfer of learning (instructional variables)? These are but a few questions that the "users" need to have answered if they are to capably evaluate their schools. The Center's research on common variables is focused on furnishing data fundamental to developing the information systems for these groups of users.

Programs

Reflecting the emphasis of the Center is the division of work into eight programs:

1. *Evaluation of Classroom Instruction*

   (Purpose: To develop and field test methods for evaluating the effectiveness of specific classroom procedures with different groups of students in different environments.)

2. *Evaluation of Elementary Schools*

   (Purpose: To develop and field test procedures for the continuous evaluation of instructional programs in elementary schools.)

3. *Evaluation of School Systems*

   (Purpose: To develop and field test management information systems and program budgeting methods for the evaluation of educational programs maintained by school systems.)

4. *Evaluation of Higher Education*

   (Purpose: To develop and field test instruments and procedures for evaluating the effectiveness of educational programs of institutions of higher learning.)

5. *Study of Instructional Variables*

   (Purpose: To identify, measure and study significant varaibles present in instructional materials and procedures.)

6. *Study of Contextual Variables*

   (Purpose: To identify, measure and study significant contextual variables which affect the educational process in different environments.)

7. *Study of Criterion Variables*

   (Purpose: To identify, measure and study criterion variables which should be included in the assessment of educational outcomes.)

8. *Formulation of a Theory of Evaluation*

   (Purpose: To identify basic principles and models related to the evaluation of educational programs.)

The first four programs are designed to develop information systems containing a variety of measures of the educational context and criteria of effectiveness. The next three programs seek to identify variables common to two or more of the evaluation systems. In a sense, programs 5, 6, and 7 conduct basic research and identify components for the user-oriented evaluation system developed in programs 1, 2, 3, and 4. This relationship can be shown by a matrix in which programs 1, 2, 3, and 4 are listed horizontally and programs 5, 6, and 7 are listed vertically.

The Criterion Problem

One approach to evaluation of instructional programs declares that a precise formulation of educational objectives in behavioral terms is an essential first step in the evaluation process. If this approach were rigidly followed, the work of the Center could become hopelessly enmeshed in in endless discussion on the question, "What knowledge is of the most worth?"

In America, control of public schools has been deliberately decentralized and the power to prescribe educational goals also has been decentralized. Some of this power is exercised by state legislatures, some by boards of education, some by influential scholars, some by parents, some by publishers, and some by individual teachers. Under these conditions, it would be presumptuous for any Center to attempt to determine the specific goals of American education.

The Center does not seek to prescribe a single criterion of effectiveness. Rather, the Center assumes that multiple criteria selected by appropriate agencies will be used. Thus, the aim of the evaluation procedures is to present relevant evidence to designated users for their decision-making purposes.

The criteria are basically of three types:

1. Number of units produced, such as number of students graduated,

number of books circulated, number of counseling interviews, etc.

2. Student achievement based upon test scores, student community services, post graduate success, etc.
3. Evidence relating to the social value of, or individual satisfaction derived from, specific school experiences.

The first of these criteria can be quantified quite easily; the second can be quantified to a lesser extent; and the third probably will remain in the subjective domain. All three types of evidence must be presented to, and considered by, each user. It would be most unfortunate if the *importance* of evidence were determined by its quantifiability.

For some types of educational programs, specific behavioral objectives can be stated. A compensatory instructional program may be intended to improve the reading ability of disadvantaged children. Obviously, one of the criteria for evaluation would be improvements in reading test scores. But this alone would be insufficient since significant side effects might occur. Moreover, the expected increase in the reading score would be related to many contextual factors. Even programs with specific objectives, therefore, need to be evaluated in a broader context.

The Center is now engaged in evaluating a compensatory program--the Los Angeles Model Mathematics Program (LAMMP) for children of normal intelligence but who have tested one or more grade levels behind in mathematics achievement. California Senate Bill 28, which authorizes LAMMP, stipulates that an outside agency must evaluate the program. Accordingly, the Los Angeles School District contracted with the Center to do the LAMMP evaluation.

LAMMP operates at three Demonstration Math Centers located at three Los Angeles junior high schools. Students in the program are seventh graders, mostly ages 12 to 13.

The specific objectives of LAMMP are a) to improve mathematics skills and understanding of mathematical concepts; b) to improve the pupil's self-image; c) to identify specific assets and limitations relating to the learning process; d) to develop and use special instructional materials and programs, and to assess their values; and e) to select and use appropriate commercially developed equipment, instructional materials, and programs, and to assess their values.

Consideration of contextual variables is indispensable to the LAMMP evaluation. A sociological questionnaire developed at the Center was used to gather information on the backgrounds of the students. Many of the children come from families where English is not the primary language spoken at home. Many have a cultural heritage that is different in some respects from the norm toward which instructional material often is directed. As a result, a study on language communication is part of the LAMMP evaluation.

An attitude-toward-school instrument also was constructed at the Center to further examine contextual variables. It consists of a series of pen drawings, each depicting a scene from one of the content areas: a) school content-general (classroom, playground, assembly, teacher-child interactions); b) school activities-specific (social studies); c) school activities-specific (math activities); and d) intellectual activities-general (science, library, museum, etc.). Like most instruments for the LAMMP evaluation, it is presently in the data analysis stage.

LAMMP provided a field-testing situation for criterion instruments developed at the Center. The new instruments were given along with the Iowa Achievement Test during pretesting (fall, 1967) and posttesting (spring, 1968). Classroom observations were conducted in the interim.

The LAMMP Diagnostic Achievement Test, designed as a change-sensitive instrument, measured abilities in mathematics on two dimensions, i.e., type of mental process or skill, and nature of content. Each item can be classified on both of these dimensions, and the entire test can be presented in a matrix covering all items on both dimensions.

Tests to determine level of cognitive development also were given: individually administered tests, based on Piaget's tasks, during the pretesting; and a group-administered test, on grouping, during the posttesting.

This brief discussion of LAMMP illustrates the point made earlier, that even programs with specific objectives require development of instruments capable of producing information for comprehensive evaluation. Education is a complex mixture of people and resources, which cannot be evaluated in isolation. With an innovational program like LAMMP, children are presented fresh opportunities to become involved in learning, departures from the pen-and-pencil routine such as three-dimensional bingo games for solving arithmetic problems. The Center, too, participated in the innovation in order to evaluate LAMMP's unique elements as well as those common with other, more standard approaches to math instruction.

The LAMMP evaluation is illustrative of the continuity of research and development resulting from the Center's program orientation, which will permit the work on LAMMP to be incorporated into the programs on criterion and contextual variables. Thus, the LAMMP evaluation when completed in December, 1968 will contribute to developing components of the information systems.

Identifying Relevant Evidence

The procedures for selecting, processing and presenting evidence are of fundamental importance, since the Center's primary concern is with the selection and presentation of evidence relevant to evaluation rather than with making value judgments about instructional programs. Although these procedures are not the same for all programs, there are common elements.

For example, under Program 2, Evaluation of Elementary Schools, an evaluation report format is in the early stages of development. The purpose is to produce an instrument for preparation and presentation of an annual report to a school principal and staff for review and interpretation in cooperation with representatives from their superintendent's office.

Limited field testing of the elementary school evaluation system was made during the spring, 1968 and the data are being processed. Analysis of these data will provide the bases for changes in the system before more extensive field trials are undertaken next year.

Orientation

The CSEIP research staff are predominantly UCLA faculty and graduate students. Two educational researchers are engaged fulltime in CSEIP research activities, which combined cover the areas of measurement and evaluation, data processing, test measurement, and experimental design. The research assistants represent diverse disciplines, among them educational psychology, educational sociology, educational administration, economics, and mathematics. A training program for research assistants has been established that includes seminars on basic research areas and special sessions devoted to data processing and computer operations.

The Center held the three-day invitational Symposium on Problems in the Evaluation of Instruction in December, 1967 on the UCLA campus. The principal speakers and discussants were Dr. Benjamin Bloom, University of Chicago; Dr. Robert Glaser, University of Pittsburgh; Dr. Robert Gagne, University of California, Berkeley; Dr. Dan Lortie, University of Chicago; Dr. Samuel Messick, Educational Testing Service at Princeton, New Jersey; Dr. Marvin Alkin, University of California, Los Angeles; Dr. David Wiley, University of Chicago; and Dr. Martin Trow, University of California, Berkeley.

During the summer of 1968, a national conference on program accounting was sponsored by the UCLA Center. The conference analyzed various approaches to program accounting. Increasingly the wide interests of the staff, reflected in the Center's publications, are being focussed upon a more limited definition of evaluation of instructional programs.

Evaluation of the Center's Program

Evaluation of the work of the UCLA Center must be in terms of the specific purposes for which it was established. Any significant contribution to improvement in public school evaluation theory and practice must result from research and development processes which necessarily require more time than the brief two year lifespan of the UCLA Center. However, identification of five questions which must ultimately be answered is useful for planning the work of the Center.

1. Are the products of the Center (evaluation instruments and procedures) likely to contribute to better practices in schools and colleges?
2. Are theoretical formulations developed at the Center likely to contribute to a better understanding of the evaluation process?
3. Are the faculty and resources of the UCLA Graduate School of Education contributing effectively to the work of the Center?
4. Are the resources of the Center contributing effectively to the production of graduate students qualified to disseminate the products and theories developed at the Center?
5. Are the costs of the Center reasonable compared to the overall output of the Center?

Answers to questions 1, 2, and 5 will require information concerning the impact of the output of the Center upon American education, which cannot be assessed immediately. Evaluation of the Center during its initial years, therefore, will require judgments concerning the probable effects of its output, and in this respect there are hopeful expectations.

Questions 3 and 4 relate more to process and remain to be judged from operations of the Center.

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RESEARCH AND DEVELOPMENT CENTER FOR SOCIAL ORGANIZATION OF SCHOOLS

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RESEARCH AND DEVELOPMENT CENTER FOR SOCIAL ORGANIZATION OF SCHOOLS

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The Johns Hopkins University Center for the Study of Social Organization of Schools and the Learning Process is the most recently established of the nine research and development centers funded by U.S.O.E. It began operation on September 1, 1966.

The principal objectives and focus of the Hopkins Center may be summarized as follows:

> The Center is concerned with the influence both of schools' social and administrative organization and of the community on the learning process of students from diverse social, economic, and racial backgrounds. The problem area defined by the Center extends from education at the classroom level to education at the national level. Research is being conducted to uncover the pragmatic effects of schools' social organization on learning, as well as the mechanisms through which these effects take place. Studies are investigating various organizational and administrative arrangements in education including personnel policies, classroom organization and scheduling, racial and socio-economic integration of schools, informal social structures among students and teachers, organizational patterns throughout the system, and the relations between levels of education. Other work of the Center focuses on linguistic and cognitive development itself, particularly those aspects of the learning process which are likely to be responsive to differing educational and social contexts. Center staff members are seeking to develop innovations in organization and curriculum and to disseminate their results among educational institutions. It is expected that most of the Center's activities will result in explicit policy recommendations and pedagogical innovations which will improve the education of socially disadvantaged children.

At the request of U S O E , the Center focused its attention and resources during the first year of operation primarily on basic research in the area of school desegregation and its effects on students of varying racial and ethnic backgrounds. This problem involves one of the six crucial areas listed by U S O E as being in need of more intensive basic research. Such a focus is consistent with the original broad problem towards which the Center is directing its resources--the relationship of the social organization of schools, both formal and informal, to the learning process. The patterned relationships among students and teachers of different racial backgrounds are clearly one crucial component of the social organization of schools. In its second year, the Center inaugurated four new programs of research and development, each comprised of a number of projects. One additional program has been developed for initiation in September, 1968, the start of the Center's third year of operation.

The following sections of this paper will describe the original desegregation research conducted by the Hopkins Center and the five programs of research and development by means of which the Center hopes to progress towards accomplishment of its goals and objectives. Several exploratory projects not yet organized into a unified program of activities are also outlined. These program and project descriptions serve as a measure of the Center's past success and as an indication of the nature of its future activities.

Research on School Desegregation

Two critical considerations concerning school desegregation are (a) the extent to which cities attempting to cope with the administration of racial integration are confronted with hampering conditions, and (b) the identification of the nature of effects of school desegregation on Negro and white students. The Center initiated research on the administrative problems through a case study of the difficulties experienced in the achievement of school desegregation in one city, Baltimore, Maryland. The nature of segregation effects was examined in a study of a large sample of metropolitan northeastern students obtained from the *Equality of Educational Opportunity* survey (Coleman, *et al.*, 1966).

The study of school desegregation in Baltimore (Walker, Stinchcombe, and McDill, 1967) had the twofold aim of describing the history of racial composition of that city's schools for the eleven years since the Supreme Court school desegregation decision, and of searching for causes of the failure to implement the desegregation decision, where failure was encountered. Researchers made use of information on the racial composition of each school in the city, as well as schools in the surrounding county suburbs for the entire eleven-year period since 1954. Additional data from the U.S. Census provided a picture of the racial character of, and the population migration patterns in the neighborhoods surrounding each school.

The study had the immediate outcome of providing a detailed statement of the difficulties faced by the Baltimore Metropolitan Area in making progress towards school desegregation. However, the research results were not limited to a picture of this particular city. The researchers confronted the problem of developing an index for the analysis of segregation that would reflect the migration patterns and demographic characteristics of the population areas served by the various schools. Existing segregation indices utilized in other studies were reviewed and found inadequate for the solution of this problem. Consequently, a new measure, the "replacement index," was developed and its relation to other widely used indices was demonstrated. This measure has been employed subsequently by other researchers of segregation patterns (e.g., Farley and Taeuber, 1968). A computer program and "analysis package" were also prepared for other school systems desiring to perform analyses for their systems similar to that for Baltimore.

In addition to the methodological by-products of the research, the substantive findings for Baltimore were widely publicized in the area, and have been used by some educators in developing future school plans and policies. The Center report documented two reasons why the Baltimore Metropolitan Area has not been able to make significant progress over the years in school desegregation. The first has been the importance of existing school boundaries between the central city and surrounding suburbs. Racial migration across these boundaries has meant that the number of schools "desegregating" has been offset by the number of schools "resegregating." Second only in importance to the suburban boundaries is private and parochial school segregation within the city. The vast majority of students in private schools are white. Consequently, efforts to decrease segregation within the public school system of the city have been largely vitiated, for the white students who might go to school with Negroes are largely in private and parochial schools or in the suburbs. In view of these findings, the Center report offered policy recommendations directed at reducing the effects of political boundaries and neighborhood differentiation.

Until the completion in 1966 of the extensive Office of Education survey, *Equality of Educational Opportunity*, little information had been available for directly testing the effects on students of attending segregated and desegregated schools. Although the original Office of Education report did not emphasize the effects of desegregation, several staff members of the Hopkins Center had been involved with the survey prior to the establishment of the Center. Thus the Center was well prepared to carry out further analyses of these data since some of its personnel were already familiar with the character and design of that survey, and the data were available to them. Under a contract with the U.S. Commission on Civil Rights, further analyses of the survey data were performed by the Center staff and reported in the Commission's study, *Racial Isolation in the Public Schools* (1967). Other publications on desegregation effects originating from the *Equality of Educational Opportunity* research have been prepared by Center staff subsequently (McPartland, 1967 and 1968).

Many findings resulted from these analyses concerning the desegregation effects on different dimensions of student development and the particular aspects of desegregated schooling which appear to be influential. Generally, Negro students were positively influenced by desegregated schooling in their level of achievement, sense of opportunity, and racial attitudes. White students' achievement was not affected in general but their racial attitudes did appear to change toward more acceptance of Negroes as a result of attendance at desegregated schools. However, the important differences between segregated and desegregated Negro students were largely offset if certain internal conditions existed within desegregated schools. The Center investigations indicated that most of the effects of desegregated schooling are eliminated for those Negro students who are in segregated classes or who are socially segregated within desegregated schools.

Four different situational factors were identified as distinguishing the desegregated environment from the segregated one. These were the social class "mix" of the student body, the racial composition of the students, the level of competition in the school, and the degree of social integration of students in the informal affairs of the school. Social integration appeared to be the major factor which explained the greater willingness of desegregated Negro students to choose interracial association in the future. The change in the level of competition appeared to explain the decrease in Negro students' academic self-confidence which accompanied desegregation. The increased sense of opportunity expressed by desegregated Negro students seems to be influenced by the racial mix per se, rather than any of the other situational factors. Finally, the growth in Negro students' academic performance due to desegregation seems to derive from three factors: social class and racial mix as well as social integration.

Although the Center has broadened its research focus since the first year of operation to include topics of more general scope than desegregation, research on various aspects of this topic has continued, reflecting a sustained interest of staff members in this topic. For example, a number of Center reports on educational policy and practice have been published, papers which have dealt with the consequences and future implications of desegregation (Coleman 1967a, 1967b, 1968). In addition, the Center program beginning in September, 1968, will focus on the operations of school boards; in particular, it will deal with the conditions affecting school board decisions with regard to desegregation.

Current Research and Development Programs

In its current activities, the Johns Hopkins Center is organized around five major programs. Each program is composed of several research and/or development projects. Four of the programs have been underway since the start of the Center's second year of operation in September, 1967. The other one will begin in September, 1968. These five programs are as follows:

Simulation Games

Education and Social Change for the Negro American: The Development of a System of Social Accounts

Socialization, Social Class, and Cognitive Skills

Standard Language Acquisition in Educationally Disadvantaged Children

The Politics of Public Education: Comparative Study of School Board Operations

Simulation Games

The basic premise of this program is that greater student motivation for learning, an increase of intrinsic interest in certain topics, and greater acquisition of information and ideas can be brought about by modifying the reward structure of the classroom. One device for altering the allocation of classroom rewards is thought to be academic games. Games function as a learning device because they are intrinsically attractive to students and encourage a new kind of cooperation among them. Moreover, they shift emphasis in the teacher role away from maintaining control of the classroom and evaluating individual student performance, and move the teacher's role in the direction of informal interaction, discussion, and coaching.

The games developed at the Johns Hopkins Center are a combination of the game-like techniques which have long been used by teachers to arouse student interest and the relatively novel techniques of simulation. That is, the games are designed to mirror some complex social process or aspect of social interaction which the student is expected to appreciate in a more thorough way after his experience in playing the games. Simulation games, then, are not merely devices for *motivating* students to study further in the area after the play is over, but players learn from their very participation in the game.

To take one example, in the Legislative (or Democracy) Game, six to ten student players are each designated as legislators and the game requires them to act collectively as a legislative body. Each student receives a set of cards on which are printed the attitudes of his constituency regarding issues facing the legislature: "Federal aid to education - 70 persons against, 30 persons for. Retaining military base in your constituency - 250 persons for, 50 persons against." Playing the game involves short speeches, informal bargaining with other legislators, and formal sessions of the legislature under parliamentary rule. Players succeed by getting themselves re-elected at the end of the game which, in turn, is dependent on their success at passing or defeating issues according to the wishes of their constituencies. The Legislative Game involves seven additional levels of progressive complexity beyond the basic version described here. Research indicates the large majority of student players perceive that success in the game is a function of exchanging support or cooperating with other legislators. In other words, the fundamental principle behind the game's construction is effectively communicated in the playing of the game.

Since 1962, prior to the establishment of the Center, faculty researchers at Johns Hopkins have been developing academic games which simulate social situations and conducting research on the processes which make simulation games an effective learning device. Because of its early beginning, this Center program has moved most fully into the development and dissemination phases. Twelve simulation games have been developed, some with several alternate versions. Curriculum kits to accompany the games are being devised, teacher's manuals are being written, and Center staff have conducted a large number of workshops and demonstration sessions with teachers and administrators in the process of disseminating the products of the program.

The establishment of the Hopkins Center resulted in the expansion of all phases of the program. The program has developed additional games for use in the high school social studies curriculum. Given the Center's concern with the problem of desegregation and its effects upon students of different racial and ethnic backgrounds, projects have also been undertaken which compare the effects of games upon disadvantaged and advantaged students, both in the United States and other cultures.

Games appear to "work" within the social organization of the classroom in an effective manner. Yet, it is only recently that research has been conducted into the question of *why* games work. To date, the question remains unanswered, but the success of games for educating and stimulating students has continued to puzzle investigators and is leading further and further in the direction of a formal theory of autotelic behavior. The peculiar fascination of games has been incremented to some extent by the growing realization that the construction and observed demonstration of games in simulated environments demands of the researcher that he formulate theoretical concepts to explain the behavior to which he has given rise. In this way, as one social scientist has put it, it has been found that "construction of social simulation games constitutes a path toward formal theory that is an alternative to the usual development of concepts and relations in verbally stated theory." (Coleman, in Boocock and Schild, 1968, p. 50.)

While research proceeds on several fronts, the dissemination activities of the Games Program have correspondingly increased. To date, more than 11,000 copies of the Program's twelve games have been distributed to schools, 4-H clubs, and other interested agencies. During the past year, Center personnel conducted 114 workshops and conferences, and distributed 3,000 information folders on the games. A film, a book, nine journal articles, five major reports, and three dissertations have resulted from the research into games with simulated activities. The Program's activities have been widely publicized by means of two nation-wide television programs and four magazine articles in the popular press.

Future research on games with simulated environments will be directed towards refining some of the development implications of the program. For instance, through the affiliation of program staff with the simulation and games committee of the National Council for the Social Studies, Center games will be evaluated for their precise applicability to current curriculum needs in this area.

Education and Social Change for Negro Americans: The Development of a System of Social Accounts

The need for a system of "social accounts" for American society has increasingly occupied the attention of social scientists in recent years. According to one formulation, social accounts is a set of balance sheets enabling one to list over time the assets and deficits of major subgroups within the American population, together with a specification of the conversion processes whereby deficits are converted into assets. Such a system of accounts, when developed, adequately tested, and maintained, holds the promise of at least three major scientific and policy advantages. First, social accounts promises to furnish a more adequate means for assessing the direction and extent of social change for various subgroups within the United States on the basis of regularly collected and analyzed data. Second, research in the social accounts framework is intended to contribute to a continual refinement of the basic theory of the processes of social change and social mobility. Third, the system of social accounts and conversion processes could serve as a guide to social policy by identifying the crucial areas where policy manipulation might be expected to have the greatest impact.

Center personnel have chosen to investigate the role and organization of the institution of education in the context of research on the development of a system of social accounts. Within this concentration, studies are being made of the coordination of education with conditions and changes in other sectors of American society, such as the occupational system. Other investigations are designed to seek a better understanding of the ways in which schools may function to transform very specific deficits of particular groups at different points in the life cycle. Finally, conditions in society which impede the development of the educational system or facilitate the functioning of schools as an effective conversion institution are investigated. In all of this, a special emphasis is given to social change as it affects Negro Americans.

Secondary analysis of data from the *Equality of Educational Opportunity* survey has taken a new tack: Regression analyses have been conducted under a strategy of "hypothetical experiments." These exercises address such a question as "What would be the verbal achievement level of Southern Negro students if they possessed the family background, teacher, school, and fellow student resources of Northern whites?" The research has attempted to provide an answer to this type of question by substituting the resource values of the latter students into the regression equations pertaining to relationships for the former students. Educational outcomes which might be expected to result from other constellations of inputs for various groups of students have also been calculated. Taken together, these separate exercises begin to specify more exactly the particular components of schools which facilitate the operation of this institution for converting existing deficits into assets. Different educational outcomes measured in these studies permit judgments about how the outcomes of schooling relate to entrance into adult positions in the military service and occupational structure.

From a different perspective, the investigators have begun the design of a computer simulation of educational and occupational processes on a nationwide level. The simulation, using Monte Carlo techniques, operates in the following manner. Data records, representing characteristics of households, are passed through a set of computer simulation programs. Each pass represents a time period, such as a month or year. The output from a pass is a changed set of data records, the computer program having altered the characteristics of the households in ways that mirror real world changes in households over the time period involved. The time period is a small one, and the simulation is repeated on the same population again and again to represent the passage of many years. At the end of each simulated year, a census of the population is taken, time series and trend lines constructed, and in this fashion the social accounts of the population monitored.

The simulation will cause births, deaths, marriages, divorces, and regional and residential mobility to occur in the household records of the population. Other phases of the simulation programs determine how an individual passes through the educational system and how his educational assets are translated into a given level of occupational prestige and how, in turn, his children's education is affected by his own accomplishments. The simulation technique will be employed for conducting more "hypothetical experiments" upon a population. For example, it has recently been shown that education has somewhat different results in occupational prestige for white and Negro Americans. The higher a Negro's educational attainment, the lower the conversion of educational assets into occupational prestige *relative to conversion by whites of the same education.* What would happen to the occupational distribution of Negro Americans if their educational "conversion rate" were identical to that of whites? In effect, what would happen if occupational discrimination were eliminated? In a simulation, these kinds of questions concerning the impact of education on the life cycle can be addressed, by artificially changing the conversion rates and examining the simulated outcomes.

As a third major activity, efforts have been directed toward identifying those assets and deficits which are most poorly conceptualized and for which empirical data are particularly scarce. This has resulted, first of all, in some extensive reviews of the literature (Blum and Rossi, 1968). In addition, the program staff have organized regular research meetings directed at planning for the collection of new data.

Three national interview surveys of Negro and white adults are at different stages in the construction of interview schedules, pilot testing of instruments, and administration and analysis of national studies. The three surveys are an investigation of intergenerational changes for Negroes and whites, a field survey of the links between events in the life cycle of individual Negroes and whites, and a study of community resources.

One study for which some data have already been collected seeks to determine the relationships among characteristics of three generations: the respondent's parents, the respondent himself, and the respondent's children. This study is intended to further knowledge of the ways in which educational gains and other resources are transmitted across generations.

A second survey gathers information on the appearance and time of occurrence of many kinds of events in the life cycle of individuals. These events include full time and part time education, occupational and residential changes, and the formation of families and change in family structure. This survey makes use of long "calendar sheets" whereby the respondent checks estimates of the time of certain events against his knowledge of dates of other occurrences in his life. This survey provides unique information on the lapse of time between different kinds of changes, the sequence of different events, and the relationship between early states and later events in life.

The third field study measures variables which are believed to be related to the likelihood that characteristics of a community will serve to augment resources of individuals within the locality. Two such dimensions are the amount of cohesion in the community, and the level of "trust" among the individuals in the neighborhood.

Socialization, Social Class, and Cognitive Skills

The major objectives of the program are (1) to develop methods of measuring certain cognitive skills and habits whose role in the general learning process of young children is poorly understood; (2) to identify the importance of these selected cognitive variables for the classroom achievement which is measured by the standardized tests; (3) to contribute to knowledge of the relationship between the appearance and development of these cognitive skills and socialization practices within the family and school; and (4) to propose modifications in classroom organization and practice which affect this cognitive development.

The cognitive skills and habits which have been selected for concentrated study are the need to achieve (nAch), the need to know (curiosity), attention as influenced by an individual's time and distance frames of reference, and syntagmatic and paradigmatic variations in verbal behavior. Much of the prior research on these variables has been conducted with college-level subjects. Therefore, a major portion of the early work of the program is concerned with devising and adapting measuring instruments for studying these factors in young children, where it is believed that socialization influences have already had strong effects on the learning process.

There are at least two reasons for identifying variations in these cognitive components in order to increase this understanding of differences in classroom performance on standardized tests. First, it is important to identify the strengths as well as the weaknesses which children from different social backgrounds bring with them to the classroom. Initial studies in this program have indicated that inner-city children may be more advanced in some aspects of language development than children in the suburbs. The identification of previously unrecognized assets of inner-city children can provide one basis for practices which will encourage their growth in other ways. Second, more adequate explanations for differences in student performance on standardized achievement tests require a more complete theory of the learning process to which the proposed studies of the subtler aspects of cognitive development will contribute.

Besides investigating variations across contrasted cultural and regional groups, the links between cognitive development and specific socialization processes which occur in different families and schools will be examined. These studies are intended both to contribute to a theory of the learning process and to be the basis for suggesting modifications in classroom practies.

As knowledge is gained of the variation in the selective cognitive and motivational components, how these variations relate to other aspects of academic growth, and the kinds of socialization processes which explain some of these differences, it is expected that a new basis for designing classroom environments will be provided. Indeed, it is a premise of this program that the ability to measure in young children such cognitive skills and motivational components as curiosity, attention, and the need to achieve must precede suggestions for modifications in classroom organization which can be shown to affect the learning process at this age level. Different classroom organizations will be suggested and studied as other phases of this program continue.

The major steps of the program which will be taken to achieve these objectives are as follows. First, the "natural variation" across subcultural groups will be measured in order to determine the distribution in types of skills and habits which are exhibited by certain groups and social categories.

Secondly, the patterns of development of these cognitive skills over a broad subcultural range will be documented, and specific teacher-child and parent-child interactions will be studied that may shape these skills. These studies will help illuminate questions on how socialization within the family and school are related. Are some skills which are present and developed in the family either lost or eroded as disadvantaged groups enter and continue in school? Or are school programs which ordinarily affect cognitive development facilitated or impeded by socialization practices which distinguish certain subcultural groups?

Thirdly, investigations will determine whether these developmental phases are amenable to manipulation so that certain deficiencies can be overcome through different modes of classroom organization. Studies will focus on what are the specific ways in which classroom innovations or re-organizations can aid in the development of these skills. Thus, it is hoped that this program of research will lead to definite policy recommendations as to how selected cognitive skills can be used or developed to enhance a student's classroom learning.

There are ten projects organized under this program for meeting these objectives. One of these projects, "Comparison between Rural and Urban Socialization Practices," is the research which stems from earlier work done in this area on rural-urban differences in sociolinguistics. Refined studies of word association responses show striking differences in the semantic systems of groups within the city (Negro and white inner-city children) and also differences between both of these inner-city groups and suburban children (Entwisle and Greenberger, 1968). A study of responses for rural groups is in progress. This will permit comparisons with the several types of responses in urban groups. Moreover, work in other cognitive domains (perception of space and time) with rural children and also specific rural family socialization practices are being undertaken.

Another project, "Incidences of Adjectives," will begin in the summer of 1968 and will be carried out in collaboration with the program on standard language acquisition in educationally disadvantaged children. Written records from the Socialization Program and spoken records from the Linguistics Program will be surveyed to determine the frequency of adjective usage within certain groups. It is hypothesized, for example, that disadvantaged children use less variety in adjectives and use them less frequently than do middle-class children, and that Negro children lag behind white children on these measures. Thus it is expected that differences will be found in the pattern of adjective usage by social class and ethnicity.

A third project will study family socialization practices in an effort to explain the well known relationship of birth order of children and academic achievement. Parents of children at three grade levels (Grades 2, 5, and 9) will be interviewed and observed in an effort to identify specific socialization practices employed with first-born, but not with other children.

A fourth project will attempt to isolate and describe pertinent variables which influence the nature of rewards for students in the elementary school social system. This study of the socialization process within the school will make use of a portion of the data collected for the *Equality of Educational Opportunity* survey.

The remainder of the projects under this program are directly concerned with two central variables in this program, the need to achieve (nAch) and the need to know (curiosity). These projects are concerned with the development and validation of measuring instruments, using both projective and teacher-rating techniques. Modified forms are being developed and tested for use with ninth graders and tested for use with ninth graders and students from five to seven years old. Scoring procedures and administration manuals have been prepared.

Information from field studies of these instruments will be used for other purposes in addition to that of testing of the instruments. Studies of the distribution and variation of these cognitive skills in certain groups differing in age, sex, and ethnicity have been completed and are forthcoming in a Center report.

An additional project invoves an evaluation of a training program designed for sixth grade disadvantaged Negro youngsters to increase need achievement (nAch). The instruments developed in other projects will be used for evaluation of this training, and this work will serve as a pilot study for further development of training procedures.

Standard Language Acquisition in Educationally Disadvantaged Children

The major objective of the fourth program is to develop instructional techniques and approaches for the purpose of providing children with a command of spoken standard English. The instructional techniques to be developed will in large part be of a programmed, self-instructional form.

The intent and activities of this program of research and development further the progress toward the goals of the Center in several ways. First, in terms of the learning process of disadvantaged children, it is clear that the child whose first language is a dialect different from the standard English employed as a medium of instruction in the schools, is handicapped in his ability to profit from verbal and written instruction. It is important to note that these are children who are administratively classed as "English-speaking," a categorization which *ipso facto* obscures the extent and nature of the linguistic problems involved. The approach of the program is remedial only by the fact that it seeks to correct or develop standard English that thas been only partially and inadequately learned. It is *not remedial* in that its approach is to teach standard English as a second language, not as a replacement of the language used either at home or with the student's peers. The objective of the program is to provide the child with the ability to use standard English and to discriminate among situations in which its use is appropriate.

Secondly, with regard to the social organization of schools, the research on self-instructional programming and the learning characteristics will have important implications for the introduction of innovations into the organization of the classroom. Programmed self-instruction, like simulation games, alters the traditional teacher-student relationship. Instead of the usual situation in which information flows from the teacher with student responses providing feedback to the teacher, self-instruction provides an approach in which the student can initiate and maintain the information flow with feedback provided to the student at an empirically derived, individually optimal rate. Even in classes with reduced student-teacher ratios, the teacher is seldom able to attend to individual needs to the extent required for training disadvantaged students in complex motor-concept skills such as oral language acquisition. In providing a means for involving the student in more active participation in the learning situation, this program's approach is consonant with the Center focus on the organizational properties of the learning situation.

Under the direction of a linguist with extensive experience in developing programmed self-instructional units for teaching French, the program has adopted a diversified approach that will take into account not only the linguistic characteristics of the native and standard languages, but also the distinguishing social and attitudinal factors associated with the functions of each. Several coordinated projects and research activities have been defined within the last year in the process of working toward the principal goal of the program. The initial group of interest is fifth and sixth grade students. The core program activities for the present and immediate future are as follows:

1. Linguistic research on the speech of the subject population (inner city Negro and white children).
2. Modification of a simulation game for the purpose of investigating role perception and language behavior.
3. Design and development of a pre-program familiarization sequence, diagnostic sequence and instructional units.
4. Programming research addressed to questions of the compatability of specific programming techniques to the learning characteristics of the student population.
5. A sociolinguistic attitude survey, a pilot study on the attitudes toward standard and non-standard speech held by the student population and by adults who are in frequent contact with the student population.

The first project above has as the major objectives a description of the speech of the student population. The study of intra-individual variation in the production of speech patterns is being emphasized. A preliminary study undertaken in several Baltimore City public schools (Garvey and McFarlane, 1968) indicates that the speech of inner city children differs from standard English and that the differences are to some extent systematically distributed by subgroups in the sampled population. In this study performance of students on echoic repetition of test sentences embodying different structures was analyzed. Further research in this project will include examination of samples of free responses in speech and writing from dictation. Variatons will be described and linguistic and extra-linguistic conditions of the variation will be identified. A follow-up of the preliminary study, which examines the relationship between reading achievement scores and repetition scores of the subjects, is in progress. This latter analysis will be used in developing diagnostic sequences under the project concerned with instructional materials. Diagnostic sequences are a first step in the preparation of instructional materials and are intended to identify specific needs to use in placing a child at the appropriate point or activity in the instructional program.

A second project is related to the linguistic research activities. A game developed by the Simulation Games Program has been revised for the purpose of studying styles of speech as these styles interact with different role-playing behaviors. The recorded game sessions from this project provide an important corpus of speech for analysis. The game itself is also being used in a study of role perception of this student population.

The third activity of the program is to carry out the planning, writing, and preliminary evaluation of the instructional materials. This project is only in its initial stage. The first step in the project is a coordinated design of subject matter content, linguistic content, a description of behaviors which comprise the terminal objectives of the program of instruction, and a description of programming strategies and presentation of techniques. The next step is the production of a pre-program sequence to familiarize the students with the format and procedures to be used in instruction. The diagnostic sequences will attempt to identify specific instructional emphasis and requirements of each student. In subsequent steps instructional units will be developed and tested. Attention will be devoted to each of these activities in 1968 and 1969.

Another project subsumed under this program involves a study of the influence of programmed instruction on the learning characteristics of educationally disadvantaged students. Treating programmed instruction as a modification of the social organization of the classroom, the research to be conducted under this project will compare the reactions and learning processes of advantaged and disadvantaged children using self-instructional materials. These studies will be designed and executed in late 1968.

The final project organized under this program is a socio-linguistic attitude survey. The intention underlying this piece of research is to examine the value judgments made by students as well as teachers concerning individuals who exhibit different patterns of standard and non-standard speech. Results derived from this research will be utilized in subsequent Design and Development activities.

Thus the overall organization of activities under this program is to conduct research on underlying theoretical issues and then design and develop innovations for classroom instruction. At the end of the first three years of the program, a sequence of instructional units for the fifth and sixth grades, coordinated with existing language arts curricula, is scheduled for completion. Once the success of these activities has been evaluated, research and development activities will be extended to other grade levels.

The Politics of Public Education: A Comparative Study of School Board Operations

From the viewpoint of an analyst of political decision-making processes, school integration is of interest because it is a relatively new kind of issue. It is only since 1954 that school boards have been faced with the public conflict that frequently ensues when pressure is brought upon a school system for racial integration. In consequence of this novelty, organized decision-making techniques with which school boards might handle the question of desegregation have not emerged, and for any given city the outcome of the desegregation issue can take any number of shapes.

Extensive research in the area of school boards faced with the desegregation issue had already been conducted under co-directorship of faculty members of Johns Hopkins University and the University of Illinois. In an earlier study (Crain, 1968), fifteen American cities were analyzed with regard to the way in which their school boards, which are particular kinds of small, formally organized groups, make decisions. How the campaign leaders for integration conducted themselves, what they seemed to want, what roles were played by the school superintendents, how the voters behaved, and finally, what the school board member himself thought of the demands made on the board--all these varied facets and roles were analyzed over a broad range of regions and city types.

The previous research demonstrated, among other things, that efforts of the civil rights movement were mostly symbolic in orientation; that is, the civil rights leaders were more concerned about school boards' public commitment to racial equality than with the placing of the maximum number of Negro students in integrated schools. In the North, outcomes of the desegregation issue were partly dependent on the degree of influence exercised by citizen elites; in the South, where the issue is more sharply delineated, a more critical factor seemed to be the ideological position of the elite rather than their power position. Communities whose population was of relatively high socio-economic status tended to be more prone to controversy, to have weaker political parties, and consequently to have higher degrees of citizen participation in the politics of desegregation. Superintendents tended to play rather minor roles with regard to the policy of school systems on desegregation; the school boards set the tone adopted by the systems.

The central finding in studies conducted to date on the politics of school desegregation seems to be that the predispositions of school board members are the decisive element. Boards composed of persons with liberal views tended to integrate; conservative boards did not. Moreover, where school boards were elected, decisive liberal action was more likely to be forthcoming; appointed school board officials were more conservative. These findings are made somewhat striking when it is realized that the liberal or conservative political tendencies of the city's population had relatively little influence on the desegregation issue; the organization and political leanings of the board itself tended to be the important factor.

As a new Center program, the study of the politics of desegregation will take two additional steps over the previous research. First, under a grant from the Carnegie Corporation of New York City, the program will broaden the range of its research activities by extending the study to the 93 largest northern school systems. Secondly, the investigators will increase the scope of the study of adding another major issue, the financing of schools. They will address questions such as the following: How important is popular political support of the school board for raising the level of school financing? Which types of school boards press hardest for financing, for the adoption of educational innovations, for the maximum amount of federal aid, and for desegregation and compensatory education for Negro students?

This program of research further aims to explore the factors which make for differences in school board composition. It appears that some boards are dominated by top community elites while others are made up of local political, neighborhood, or ethnic representatives. Structural differences in the community which produce these differences will be examined with a view towards ascertaining which kinds of strategies would work best for school boards in different kinds of cities.

To investigate the organization and decision-making processes of school boards is to see the school in its setting as a governmental agency. The ways in which a school system functions as a political entity is an important area for research, for in some sense the administrative policy-making style of a system must trickle down to affect the education which any particular child receives. Political organization of the system which blocks or facilitates the process of trickling down has important ramifications within the school as well as throughout the larger community.

Independent Projects

In addition to the activities which are organized into the five research and development programs, the Johns Hopkins Center also supports independent projects of research in its major problem area, with the intention that these projects will develop into future programs or feed into existing programs. There are six independent projects which are either currently underway or about to be initiated.

One project, "Classroom Organization and Student Environment," studies the interplay among (1) the formal academic standards and classroom arrangements in the school, (2) the informal student norms and student environment, and (3) the rate of academic growth of individual students. In the studies undertaken in this project, the principal independent variables are the methods used by schools for grouping students in classrooms (including the degree to which students and their parents are permitted to decide upon the classes and curriculum an individual will enter), and the manner of formally evaluating student performance, together with the consequences such evaluations may have for student progress through school. A major intervening variable standing between the modifications in these formal arrangements and individual student learning is the character of the "student climate" or the informal environment established by the general student body.

This project is aimed at discovering the ways in which the informal student environment in schools can be directed toward academic pursuits. There is substantial research evidence suggesting that the student climate of a school has a strong effect on the learning of the individuals in the school. The general hypothesis of this project is that modifications in the formal reward structure and in the amount of initiative a student exercises in organizing his own formal program provide avenues for intervening in the informal norms adopted by the student body at large. The activities under this project include the development of a theoretical model which draws upon research findings for the purpose of identifying the mechanisms which link together the principal variables. Also, project staff will undertake secondary analysis of existing data and plan to mount new field investigations once the theoretical framework has been elaborated. As these activities progress, it is anticipated that detailed proposals will be made for modifications in the formal organization of schools which can be expected to effect changes in the student climate.

Another independent project also focuses on the structural arrangements in schools and educational systems. This project, "Comparative Educational Organizations, Their Inputs and Outputs," consists of a cross-national study of educational organizations. The formal structure of the educational system in eighty nations is measured along several dimensions. Differences in structure are to be related to various kinds of outcomes from the educational systems. The data for this study are drawn from many sources and have been collected, coded, and organized for measurement of the variables to be used in the analysis. Results from this project are expected to contribute to the later development and cross-cultural extension of other Center projects and programs.

A third independent project has as its purpose the determination of how the educational resources of particular school systems are allocated among the individual schools in the jurisdiction. Using data from the U.S. Census, the *Equality of Educational Opportunity* survey, and specially selected school districts, project staff have performed regression analyses to determine the relationships between school resources and community characteristics. Both the Social Accounts Program and the desegregation research of the Center will make use of the findings from this project.

Various changes in the social organization of the school are anticipated as a result of introducing the electronic computer as an instructional device in the school. A Center project is designed to study the use of the computer as a tool for learning; how computers may be employed as particularly flexible members of the class of responsive environments is being investigated. One set of activities under this project will be the writing of programs in several different areas where the computer may function as a responsive environment.

The remaining independent projects in the Center deal with various dimensions of the teacher's role in the social processes of the school. A project is being conducted involving studies of the relations among the teachers in the school as well as aspects of teacher-student interaction. A study is underway to determine what impact faculty peer group processes have on the climate of the school and on judgments and actions of individual teachers. The study is designed to separately measure the influence of the general characteristics of the faculty, the background characteristics of individual teachers, the teacher's social position vis-a-vis other teachers in the school, and conditions of the school program and operations. Although a good deal of research has been done on peer groups among students in a school, such is not the case for school faculties. Drawing theoretical propositions from the social psychology of informal work groups, project directors for this study will use data on teachers from the *Equality of Educational Opportunity* survey and supplement this information with new survey data. A separate study under this project will deal with the different roles which teachers perform in their relations with students. Students' sociometric choices of "best liked teacher" and "best teacher in different subject matters" will be used to measure the effectiveness with which teachers play, respectively, socio-emotional and instrumental roles in relation to students. The investigation will be concerned also with how particular teachers and students behave in different role environments and the ways in which school climates affect teacher-student relationships. These research activities are intended to contribute to the foundations for a theory of the social processes in the school. A final project, "Classroom Applications of Research in Expectation Theory," focuses on the teacher-student interaction process. A series of laboratory experiments is being conducted to study propositions concerning evaluations, expectations, and status in small groups. These investigations will contribute to an understanding of how teachers' expectations influence student achievement through their effects on the student's own self-expectation and his evaluation by other students. As predictions from these experiments are extended and refined, Center staff will investigate the ways in which conventional classroom techniques can be modified to enhance student development.

A set of programs and projects as far ranging and ambitious as those described in this paper does not arise out of an organizational vacuum, any more than does a school operate without essential factors of social organization. The interplay of minds and personalities which bring to bear the viewpoints of many disciplines and varied experience in Center seminars cannot be circumscribed within the framework of a journal article. One contingent deserves special mention because of its pervasive influence. The Center has established a special unit for support services in experimental design and statistical analysis. Through this unit all Center program and project staff have access to continuing and intensive consulting services. The unit aids Center personnel in designing their studies (both basic and evaluative), in incorporating appropriate statistical analyses, and in training staff members and graduate students.

Overview

The Johns Hopkins Center has attempted in its programs and projects to mobilize qualified members of disciplines who are committed to and critical of education. It has endeavored to bring together educationists, behavioral scientists, subject-matter scholars, and others who, by collaborating, could regenerate and reinvigorate educational practice where it was clearly failing in its tasks. The Center has used, not given lip service to, the multidisciplinary approach, has experienced the inevitable difficulties of this approach, and has retained the firm conviction that new advances *will* come from this avenue of scholarship and science. Its operating strategy has been to identify and pursue complex problems requiring sustained effort by a team of persons, eschewing the kind of programs which an individual or a few colleagues might do as well with a one- or two-year grant. For its development activities, the Center has brought together, in one place, some people doing exploratory research, others looking over their shoulders and picking up their findings for more applied research, and still others designing and developing usable packages to be tested and demonstrated as solutions to practical problems

Does this sound audacious? It should not. It is the substance, if not the paraphrase, of Steele Gow's "Criteria for Appraising Educational R and D Centers" (1967) to which the Johns Hopkins Center subscribes.

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PERSPECTIVES ON EDUCATIONAL R&D CENTERS

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Over a period of five fiscal years (1964 through 1968), the Federal government has invested approximately $29 million in establishing and supporting a set of university-based research and development centers in education.[1] An additional $8 million of fiscal 1969 funds will flow to these institutions. The total expenditures and appropriations of almost $40 million reflect the confidence of Federal program managers in the continued progress of the Research and Development Center Program in achieving its objectives. What are these objectives and what is the evidence of accomplishment?

The oldest centers are four years old. The youngest center is two years old. Policy makers and program managers have not yet commissioned comparative studies to determine whether investments in the Center Program have yielded more, less, or about the same research and development dividends as investments in other instrumentalities. Nor have the policy and program people systematically collected information to assess whether the Center Program is better suited to some aspects of research and development than others. Comparative investigations addressed to supplying answers to these questions are currently under consideration. For the present and immediate future, assessment of the Center Program must rest on evidence of movement toward objectives, both original and current.

The Federal Interest in Educational R & D

The Federal interest in educational

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[1] The set currently numbers nine, although the total at one time reached as high as 11. One center chose to convert itself to a Regional Educational Laboratory. Another agreed to shift the funding of its efforts from an institutional basis to an individual project basis.

research and development assumed authentic form and substance in the mid-1950's. Signal events included investments by the National Science Foundation in curriculum building in mathematics and science and the passage of the National Defense Education Act to support program expansion in foreign languages and guidance. The lion's share of Federal expenditures in the 1950's went to the support of education as an instrument of national policy in international affairs. Executive, legislative, and popular support for the new programs rested heavily on belief in the importance of education for the maintenance and enchancement of the Nation's posture *vis a vis* other countries. However, the soil was turned and the seeds were sown for investing in education as an instrument of national policy to pursue a wide array of domestic goals. The turn of climate that produced the actual growth of expenditures came in the early 1960's.

Heavy spending by private foundations on education parelleled the enlargement of Federal support. The foundations tended to emphasize educational inventiveness and innovation more than systematic research and development. Their support of innovative departures in educational practice, coupled with the stimulation of programs sponsored by the National Science Foundation and NDEA, contributed to acceptance of change and urge for reform in education. The belief that the Federal government should step up its investments in education in order to achieve domestic goals and the conviction that the Federal government should encourage needed improvement in education converged in designing and passing the Elementary and Secondary Education Act of 1965.

The Cooperative Research Program

The Cooperative Research Act also appeared on the scene in the mid-1950's. It provided an unprecendented impetus to research in education, especially in schools of education, primarily by way of channeling funds to individuals, or to small teams of investigators, to carry on research projects of their own choosing. After administering and observing "project support" for several years, Federal policy makers and program managers – together with their non-governmental advisers – reached three conclusions. First, they agreed that the Cooperative Research Program had stimulated qualitative improvement and quantitative expansion in educational research. Second, they noted that the results of the projects, and of most other educational research, did not lead directly enough or quickly enough to observable change and desired improvement in educational practice. Third, they observed that the results of small scale project research tended to be fragmented, non-cumulative, and inconclusive.

Analysis of existing conditions in education and reflection on research and development in agriculture, medicine, industry, and defense suggested a three-pronged strategy to improve the impact of the Cooperative Research Program on educational practice. The first was to shift the highest priority from knowledge production alone to deliberate improvement of the *relationship* between the production and utilization of knowledge. The second was to put greater stress attracting to educational research and development a range and diversity of multi-disciplinary talent that resided outside as well as inside schools of education, and to assemble these diverse talents into powerful critical masses. The third was to create an instrumentality in which investments could be made to achieve the desired shift and stress, and which would also serve as a legitimate alternative to support of disconnected projects.

The Research and Development Center Program

The search for useful remedial action and creative alternatives led to the establishment of the Research and Development Center Program in 1963. The guidelines for the new program reveal the mix of intentions, aspirations, convictions, and expectations that accompanied its establishment.

> "Research and development centers are designed to concentrate human and financial resources on a particular problem area in education over an extended period of time in an attempt to make significant contribution toward an understanding of, and an improvement of educational practice in, the problem area. More specifically, the personnel of a center will:
>
> 1. Conduct basic and applied research studies, both of the laboratory and field type.
> 2. Conduct development activities designed to translate systematically research findings into educational materials or procedures, and field test the developed products.
> 3. Demonstrate and disseminate information about the new programs or procedures which emerge from the research and development efforts. These activities may include demonstrations in a natural, or operational setting, the preparation of films, tapes, displays, publications, and lectures, and the participation in symposia and conferences.
> 4. Provide nationwide leadership in the chosen area."[2]

The guidelines explicitly describe anticipated scope, magnitude and time-frame for individual centers.

> "The work to be done at a center will be a major undertaking. It will require the services of a permanent core of professional staff members supplemented by the efforts of practicing educators for at least several years. The length of time will depend on the magnitude and complexity of the problem area to be dealt with and the scope of the planned approach. In addition to the financial contribution of the institution or agency, the Office of Education will probably provide \$300,000 to \$1,000,000 annually. Although the period of time for which support may be requested will not be limited, typically a proposal should describe activities for a 5- to 10- year period."[3]

Establishment of the new program signaled the intention of the Federal government to supplement investments in "project research" with support for problem-oriented "programmatic," long-range research and development efforts designed to find solutions to educational problems of national significance and to contribute to improvement in educational practice.

Designation of the new institutions as "Research and Development Centers" signified that they were to be something more than decentralized sub-funding agencies for supporting congeries of disconnected projects. The Office of Educa-

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[2 & 3] *Cooperative Research Programs: Application Instruction for Research Contracts.* U.S. Department of Health, Education, and Welfare, Office of Education, Washington: U.S. Government Printing Office, 1963, p. 27.

tion was already funding a wide variety of such projects directly from Washington. The cost of establishing and maintaining a center as an institution was seen, in large measure, as the price to be paid for initiating and managing continuous and cumulative programmatic efforts addressed to the solution of major problems.

The guidelines, and related materials, identify the following behaviors for which strong and sophisticated management is a necessary condition:

1. to concentrate $300,000 to $1,000,000 of resources yearly on a significant educational problem area over an extended period of time;
2. to allocate these resources to secure improvement in educational practice;
3. to recruit and employ interdisciplinary professional staff, and necessary support personnel;
4. to design and implement a coordinated and interrelated research and development program, or set of programs, to move in a cumulative and progressive manner toward problem solution, including the production of educational materials or procedures and the initial field testing of developmental prototypes;
5. to disseminate information about all aspects of a center's program to relevant audiences;
6. to establish close working relationships with state departments of education, colleges and universities, local school systems, and other relevant educational agencies.

The press placed on centers by OE program managers, their advisers, and non-government field visitors from the start has addressed itself primarily to the pursuit of three related objectives: first, that individual projects and activities meet the test of first-rate technical quality; second, that the activities of the centers become genuinely programmatic; third, that most activities demonstrate authentic relevance to problem solution, either directly or through the development of tested alternatives that represent improvement over existing school practice.

Technical Quality of Individual Activities

There are over forty programs involving several hundred specific projects or activities underway at the nine centers. These programs vary widely in the types of professional expertise required, the number of investigators and support personnel associated with them, in their size, in their design, in their intended outcomes, and in their costs.

The program management staff of OE is neither large enough nor skilled enough in the many areas of work involved to make wise judgments about the technical competence of the investigators or about the technical excellence of their work. Assessment and evaluation on these dimensions are really matters for qualified colleagues. Where OE staff members are appropriately qualified, they do participate in assessment and evaluation. In recognition of limited breadth and depth of staff expertise, OE has turned from the very start of the center program to specialist consultants, field readers, and field visitors to assist in observing, reporting on and assessing the technical competence of center personnel and their work.

Since 1964, over 40 specialists drawn from the ranks of distinguished educationists, educational researchers, subject matter specialists, and behavioral scientists have assisted OE as site visitors and as analysts of center documents, publications, and products. The observations, reports, and assessments submitted by site visitors and field readers have been quite favorable in their treatment of the technical competence of center personnel and projects. The records show that OE staff and their non-government consultants agree that the centers have accumulated and assembled strong senior staff members and have attracted expanding cadres of promising younger and less experienced personnel. These same records also reveal instances where site visitors have noted weak technical competence on the part of particular investigators or poor design and workmanship on a specific project. Criticisms of weaknesses and inadequacies on these dimensions represent exceptions to the general trend of reports. The general trend is commendatory and praiseworthy. Center directors generally have been quick to spot any deficiencies and take corrective action.

In relying on external reviewers, the OE program staff remains concerned, however, with the possibilities that either "senatorial courtesy" or undesirably narrow perspective might creep into evaluation process and procedures. In order to avoid these eventualities, the staff carries on a careful process of selecting site visitors and field visitors and of orienting them to the need for "hard-nosed" but balanced observations and assessments.

The nature of the external review process, and criteria employed, have provided OE with increased assurance that the competence of individuals involved and of work underway in the centers meet the standards that apply for the funding of individual investigators and work through "project support." Indeed, the amount of systematic and continuous effort applied to analysis of work at the centers easily matches, and probably exceeds by a noticeable margin, the internal and external review of separate research and development projects funded by OE.

The major difficulty to date in coming to terms with realistic assessment of technical competence in the centers is that they have literally overwhelmed the OE program staff and its outside specialists with reports, publications, and other products. Through mid-1968, almost 450 publications and papers had appeared or were in press, above and beyond annual and quarterly reports.

Up to this point OE review procedures have been stronger in evaluating proposed activities and work in process than in judging final results. The staff has been experimenting with new procedures, such as a field review held at the Wisconsin Center devoted entirely to assessing the center's developmental products, and a conference on the evaluation of Individually Prescribed Instruction (IPI) involving staff from the Pittsburgh Center, Research for Better Schools, OE, and several OE consultants. The staff is also developing a form with criteria for use in evaluating research reports.

On the matter of their ability to assemble critical masses of multidisciplinary talent, centers have had little difficulty in bringing together the range of talents found in faculties of Education. Many faculty members in Education who have joined the staffs of centers have had regular appointments in other academic departments. Success and interest in attracting the attention and involvement of prestigious and highly competent faculty members who do not have appointments in Education has varied considerably from center to center. Some centers have demonstrated notable success in assembling strong multidisciplinary cadres. In most of them, there has occured a steady accumulation of talent recruited from a wide array of fields and backgrounds. However, several centers still have not achieved significant representation on their staffs from academic departments outside the School of Education.

Programmatic Organization of Center Activites

Technical competence and multidisciplinary backgrounds of staff constitute central criteria in assessing a center's program. However, from the perspective of OE, it was never sufficient to assemble a critical multidisciplinary mass of even the most competent researchers to work on disconnected projects of their own choosing and interest, without reference to the fit of projects with one another and without reference to cumulative contribution to problem solution. Although eminently necessary, undirected research excellence cannot by itself meet the intentions of the R & D Center Program. These intentions also require the management ability and the organizational desire to marshal extraordinary human and financial resources into well-designed sets of continuous and cumulative programmatic activities.

Prior to 1964 the Office of Education had invested little in genuinely programmatic research and development in education. Establishment of the R & D Center Program marked the setting and building of a new tradition which emphasized institutional ability to select, initiate, and carry through programmatic work authentically directed to problem solution and related educational development. Achievement of a legitimate programmatic organization of activities has represented, from the start, a desideratum derived from the belief that careful planning of and deliberate connection among activities will contribute to improved and more relevant research and development.

Neither OE nor the several host universities have found it as easy as anticipated to establish new institutions committed to programmatic and linked research and development in education. "Institution-building," in its literal sense, has consumed much of the time, energy, and resources which both the Federal government and the universities have contributed to the R & D Center Program.

The most dramatic example of the difficulties involved in achieving a programmatic orientation of activities occurred in the spring of 1967 when OE and a host university agreed that the several activities underway in the "center" did not constitute a programmatic set or sets and that the university really saw the "center" as a sort of holding company for funding projects addressed in a general way to the same problem area. As a result, the funding of constituent projects was changed to a direct "project support" basis.

The building of university-located centers committed to programmatic and linked research and development in education has constituted a major development task in its own right. The collegial system of decision-making and the high value placed on professorial autonomy in the selection and conduct of research activities tends to conflict with the authentic organization of interdisciplinary teams to strive for the achievement of objectives which are organizationally defined. In addition, the basic university reward system is controlled by the various academic departments, which place higher value on conventionally defined research publication than on contributions to an organizationally defined research and development activity. In some cases, a center has required from two to three years to negotiate through the constraints of its setting in order to establish itself as a well-managed, programmatically oriented research and development unit. The constraints have on occasion resided in the center directorate and staff itself rather than in other places in the university. In these instances especially the task of achieving a programmatic orientation has often required an extended dialog with OE staff members. On the other side of the coin, the support given to the nine centers by their parent universities is impressive particularly in the face of pressures, constraints, and financial problems which face university administrators. University administrators have made it possible for important faculty members to spend considerable portions of their time in center activities, often have provided extensive space in university buildings, and have made substantial financial subsidies to the centers in both direct and indirect costs. These contributions have shown themselves as critical in the process of institution-building, especially when they are contrasted with the sources of support which have been available to the founding and growth of the regional educational laboratories.

The location of the centers in the university structures follows no single pattern. Some comprise units within a School of Education; some operate within or report to other units of a university; and several exist as separate institutes reporting directly to an official in the president's office. The specific location of centers in the university structure does not seem, thus far, to be related to any judgments concerning programmatic orientation or general performance.

In judging the programmatic status of center activities, a major distinction should be made between an active or a passive stance toward program planning on the part of the center directorate. With a passive stance, the initiative lies with individual professors to propose projects which are then judged as to whether they "fit" some pre-established statement of program objectives. Conversely, with an active stance the center directorate takes the initiative in bringing together a group whose talents are relevant to the problem area and charges them with the responsiblity for designing a systematic attack on the problem. Many centers started out with a passive approach to program planning, and given the nature of universities perhaps it is often necessary to go through this stage. However, it is doubtful that anything more than a "quasi programmatic" plan can be developed in this manner, and virtually all the centers have been moving toward a more active stance.

When the array of genuinely programmatic activities carried on in the centers is compared with the entire array of activities sponsored by centers, it is clear that much remains to be done to achieve a programmatic emphasis throughout the nine sites. Many separate and disconnected projects are still visible. Also many of the "programs" themselves really constitute examples of convenient groupings or classifications of essentially separate projects rather than sets of activities designed and initiated as integrally related to each other and planned to run over a long-term in a continuous and cumulative fashion in search of solutions to significant educational problems.

In considering the emphasis on programmatic orientation, it is useful to distinguish bewteen high priority and exclusive allocation of effort. All centers may be expected, as a matter of course, to support a certain proportion of separate and discrete projects for such purposes as commanding the attention and interest of highly respected colleagues whose contributions to the center as an institution are invaluable, or securing scare and critical human resources to serve a wide variety of center activities (such as measurement or statistical design assistance), or supporting "high-risk" efforts whose potential contributions do not neatly fit or mesh with overall programs plans. An important test of management skill is the ability to devise a strategy for the allocation of resources which provides a defensible balance between such needs and the major programmatic efforts of the center.

The nine centers vary markedly in their own internal organizational structures, in the efficiency of their operations, and in their capability and commitment to organize acitivities on a programmatic basis. Although field visitors have, over time, noted continuous and gradual increase in the capabilities of center management, probably the single greatest weakness across all nine centers resides in the ability to plan and project programs for more than one year into the future with any degree of specificity. Notable exceptions exist. Some centers have demonstrated high-level commitment to an ability for planning and generating research and research-related activities on a long-range, continuous, cumulative, and inter-related basis. Others have been slow in exhibiting warm enthusiasm and great energy for organizing their activities on a genuinely programmatic basis or for actually moving in this direction. Even so, analysis of annual reports and of other descriptive data about the centers reveals that many of them have initiated several rounds of efforts to reorganize themselves on an increasingly programmatic basis. These efforts represent more than reactions to or efforts to meet external evaluation criteria applied by field visitors, OE staff members, and advisory committees established by the centers themselves. The press for programmatic orientation and organization of activities has tended recently to shift from without to within, as the centers have fought through their internal diplomatics and as they have seen for themselves the gain and power that derives from carefully planned, cumulative, continuous, and inter-related research and development work.

Authentic Relevance to Problem Solution

As the first type of organization sponsored by OE for "bridging the gap" between research and practice, the centers were originally charged with responsibility for the total innovative process, including basic research, applied research, development, field testing, demonstration, and installation. OE's stress on the importance of development is based on the conviction that it constitutes the keystone in the set of activities that connect the production and utilization of knowledge.[4]

Basic research, by which is meant research undertaken with an objective of building a body of general propositions of empirical reference, has always been and continues to be an important part of each center's mission. The source of problems for basic research may be either the "internal" problems of theory building within a discipline, or the "external" problems of the real world. From this point of view, development-oriented research is seen as a special category of basic research, distinguishable from other categories by the source of problem generation rather than by its quality, rigor, or content. Both types of basic research are necessary parts of a center's program. Nevertheless, the need to organize center efforts systematically in relation to educational problems dictates that some primacy be given to development oriented research and thus the *linkage* between research and development.

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[4] It also is possible, as Klausmeier suggests in his paper on the Wisconsin Center, that some special forms of new knowledge can move directly to influence change and improvement in practice without passing thorough a development phase.

Entry onto the scene of several new types of institutions authorized by the Elementary and Secondary Education Act of 1965, particularly Regional Educational Laboratories, Title III Supplementary Centers, and ERIC Clearinghouse, has altered the expectations originally held for the centers with respect to the amount or proportion of effort addressed to development, demonstration, and diffusion. In addition, both the centers and OE have gained experience with the realities of generating, developing, and installing educational innovations. Center personnel, OE staff, and non-governmental advisors have all come to recognize that the mores of major universities often make it difficult to carry development beyond the prototype stage; that the costs of full-scale development, demonstration, and diffusion are too heavy for centers to carry if they are to support productive programmatic research; and that centers can and should link themselves to other institutions-old and new-for supporting the later stages of development work and significant portions of the costs of demonstrations and diffusion.

The notion of "prototype" has assumed increased importance in the set of current expectations on the centers. When a center has produced a working model of an innovation, which has been tested in at least one "national" school setting, it has brought a development to the prototype stage. Typically, working models at this stage of development are *not* ready for immediate adoption by large numbers of school systems. A great deal of further development work will generally be required to put the working model in condition for widespread diffusion. The center personnel may have tested the prototype in one school in one type of community, but they do not yet know how it will work in other communities with other types of populations. They cannot be sure of adaptation appropriate to the needs of special sub-groups in the population. Nor can the center staff be sure whether teachers will require special training before they can use the new product or process effectively.

Whether or not centers use their own resources to take development work beyond the prototypic stage is an individual policy and management decision, related to a center's own set of priorities. In the typical case in which they choose not to undertake such work directly, they are held responsible for planning and implementing strategies for linking themselves with other educational agencies for carrying their development work beyond the prototype stage and for assuming the difficult and costly effort of diffusing tested alternatives to ever-widening circles of intended users. Prototypes gathering dust on shelves serve the improvement of educational practice no better than research reports gathering the same dust. Several papers in the present issue contain descriptions of exemplary models of fruitful relationships between centers and regional educational laboratories.

With respect to the criterion of stimulating research utilization, centers have been charged with a responsibility for dissemination from the beginning of the program. Experience and conceptual analysis strongly suggest the need for distinguishing between dissemination and diffusion. The former needs to be restricted to refer to distribution of information in various forms and expanded to refer to an activity that should occur regularly at all stages of the innovative process. On this basis, research and development centers should be disseminating salient information about all their activities, including the problems they have chosen to attack and the rationale for the choice, the programs they have formulated as a consequence, and the progress and results achieved at each stage of their work. It appears preferable to restrict "diffusion" to its anthropological referent, namely, the spread or adoption of an innovative practice or alternative among potential users. As in the case of prototype *vis a vis* full-scale development, it appears suitable to hold centers responsible for planning strategies and initiating efforts to link with other educational agencies to carry on the work of diffusing tested alternatives.

By and large the centers have established good, if conventional, dissemination programs, especially with respect to their research activities. New techniques need to be and are being devised as increasing numbers of developmental products reach the prototype stage.

The stress placed upon authentic relevance to development has been the subject of a continuing dialog between OE and the centers. Several of the centers not only have accepted the charge, they built it into their operating style and program planning from the start of their existence. For others, a new commitment to development-oriented research as well as development itself is reflected in recent program reformulations.

One of the key management decisions faced by each research and development center is the allocation of resources among various functions. It should be recognized that no rigid formula for this can be established. The optimal balance among different types of activity will depend upon the nature of the problem area, the adequacy of the knowledge base, the existence of technology that can be borrowed from other fields, and other factors.

Analysis of Center Program

The program guidelines invited interested institutions to submit, essentially, "unsolicited" proposals. This approach placed much initiative in respect to defining areas of work outside the Office of Education. The researchers at the several institutions themselves defined an educational problem, or set of problems, which they felt to be of national significance to which the members of the proposing group had demonstrated a commitment, and they outlined their five-year plan to attack the problem.[5] A panel of distinguished educational researchers and behavioral scientists assisted and advised OE in screening proposals, in conducting on-site reviews, and in recommending the establishment of specific centers.

It is important to recognize the particular set of circumstances which prevailed during the establishment of the center program and at the time each existing center came into existence. No master plan of identified priorities existed at the Federal level to assist or guide program officers, and their advisers, in the choice of proposals. The program people and advisory groups were particularly concerned about locating and supporting known centers of human capability to address themselves in more systematic and programmatic fashion to educational research and development in crucial areas, of which there were many. It also seems apropos to note that neither the architects of the program, nor advisers, nor program officers anticipated that the program would stop at the level at which it has currently peaked.

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[5] "Educational problems" were defined in many different dimensions, e.g., in terms of conceptual, disciplinary, or theoretical concerns such as learning, educational levels such as higher education, professional fields such as teacher preparation, etc.

The following table (page 201) indicates how the centers have invested Federal funds for FY 68 into activities, classified on two dimensions now used by Bureau of Research planners: educational level and "input." In terms of input, centers have made their heaviest investment in instructional systems (30.2%) and educational personnel (23.1%). Two other categories have substantial representation: namely, organization and administration (16.5%) and programs concerned with the total educational institution (12.5%). That no funds appear to be invested in either facilities and equipment or resource building is partly an artifact of the classifying system. The rule that a program must be classified in one and only one category means that a program actually related to more than one area must be classified in the dominant field. For example, the Learning Research and Development Center at the University of Pittsburgh is developing new student interface devices, some controlled by computer, but this is part of a larger program on developing instructional systems and therefore is classified there. With respect to resource building, the centers are doing a very large – but quiet – job of preparing the next generation of educational researchers. Hundreds of graduate students have now obtained research training through participation in center programs. However, this contribution of the centers does not emerge readily from the present classificatory scheme.

In terms of educational level, only 15.7% of the funds are devoted to programs aimed exclusively at post-secondary education. It should be noted, however, that programs for the improvement of educational personnel are classified by the level at which the personnel will ultimately work, and thus are shown mostly as relevant to pre-college education. Although the dominant thrust of all higher education programs is best classified as related to four-year colleges and universities, these programs do contain some projects related to two-year post-secondary programs, graduate and professional education, and adult and continuing education. The classification into subcategories of pre-college education is rough inasmuch as many programs relate to more than one level.

When the joint frequencies are observed in the table, three cells turn up with 10% or more of the funds: educational personnel at the secondary level (14.3%), instructional systems for the middle school level (13.2%), and organization and administration for all elementary-secondary levels (10.1%). Perhaps the most noteworthy thing in the table is that *many of the cells are empty!* Clearly the present center program is not broad and comprehensive enough to develop programs aimed at many important problem areas.

Summary

This paper has attempted to describe the essential nature of the Research and Development Center Program, indicating how its objectives have been modified and refined by experience, conceptual analysis, and the establishment of other new agencies committed to different aspects of the innovative process. Generally the Program can point to a considerable record of

Table 1. Programming of Federal Funds by Research and Development Centers, by Input and Educational Level, FY 68
(Percent; Base = $8.699 million)

Input	Total	Early Child.	Middle School	Secondary	All Elem. & Sec.	Two-Year Post-Sec.	Four-Year College & University	Grad. & Prof.	Adult & Cont.	Other
Total	100.0	10.5	13.2	20.9	33.6	–	15.7	–	–	6.2
1. Student Capacities & Characteristics	9.1	--	–	–	9.1	–	–	–	–	–
2. Home & Community Factors	4.4	2.1	–	–	–	–	–	–	–	2.3
3. Instructional Systems	30.2	8.4	13.2	4.8	–	–	–	–	–	3.8
4. Educational Personnel	23.1	–	–	14.3	7.3	–	1.5	–	–	–
5. Organization & Administration	16.5	–	–	–	10.1	–	6.4	–	–	–
6. Pupil Personnel Services	4.1	–	–	–	–	–	4.1	–	–	–
7. Facilities & Equipment	–	–	–	–	–	–	–	–	–	–
8. Total Institution	12.5	–	–	1.8	7.1	–	3.6	–	–	–
9. Resource Building	–	–	–	–	–	–	–	–	–	–

Note: Detail does not necessarily add to total because of rounding.

accomplishment with respect to the technical quality of the work performed and the organization of activities on a genuinely programmatic basis with authentic relevance to development and the solution of significant educational problems. Where weaknesses exist, vigorous efforts are being made to correct them. Analysis of programs now underway in the nine centers reveals that many significant educational problems are not now being attacked by this instrumentality for educational improvement. It is hoped that comparative studies can be undertaken which will assess the productivitiy of this form of organization *vis a vis* other modes of organizing research and development effort.

★ U.S. GOVERNMENT PRINTING OFFICE : 1969 O—329-140

The nine Research and Development Centers have received support of approximately $28 million from the date of their inception to June 30, 1968. The source of this funding was 82% Federal and 18% local or other than Federal.

The magnitude of capital outlay from Federal, State and local sources for public education per year is measured in the billions.